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THE AMERICAN GAS LIGHT JOURNAL

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[OFFICIAL NOTICE.]

Central New York Gas Engineers Association.

OFFICE OF CENTRAL N. Y. GAS ENGINEERS' ASSOCIATION, Sept. 15th, 1882.

On account of the Meeting of the American Gas Light Association occurring upon the day set apart for the semi-annual meeting of the Central New York Gas Engineers Association, the members of the latter Association are earnestly requested to be present at the American Association meeting at Pittsburgh, where final arrangements for a session will be arranged.

CLEM. A. WHITE, *Secretary.* JOHN MCDOUGALL, *President.*

[OFFICIAL NOTICE.]

American Gas Light Association.

OFFICE AMERICAN GAS LIGHT ASSOCIATION, No. 142 CHAMBERS ST., N. Y.

The Tenth Annual Meeting of the Association will be held in the city of Pittsburgh, Pa., on the 18th, 19th and 20th days of October. The first session commencing at 10 o'clock on the morning of the 18th.

Headquarters will be at the Monongahela House, where the sessions of the Association will be held. Special rates of board, three dollars per day, have been arranged for members and their ladies. Under charge of the Committee of Arrangements, Friday, October 20th, will be devoted to visiting objects of interest in the city, a trip to the mines of the Westmoreland Gas Coal Company, and to the usual hospitalities of the local gas companies.

Ladies who may accompany members will be cared for during the sessions of the Association by a committee, who will accompany them to various places of public interest in the city.

Members who intend to present papers are again respectfully urged to promptly notify the Secretary of the fact, as also of the subject selected, so that the Executive Committee may complete its programme, and all be enabled to secure proper presentation and discussion of their papers.

Any officer of a gas company, person skilled in gas manufacture or industries connected therewith, is qualified for membership in the Association, and can obtain blank forms of application by applying to this office.

WM. HENRY WHITE, *Secretary.*

THE STUDY OF ELECTRICITY.

A little more than four years ago those whose business it is to supply illuminating agents to the public were somewhat startled by the wonderful announcements sent forth by the promoters of schemes for electric lighting. Almost simultaneously a half dozen different systems burst forth, and since then the records of the patent offices of the different nations of the globe bear wonderful testimony of the fertility of man's inventive genius in attempting to grapple with the practical working out of problems whose solutions were, to a very large extent, empirical.

The very science of electricity was in its infancy, and, as yet, the information empirically, and perhaps, in some instances, theoretically obtained, had not been brought together and formulated under fixed heads and subdivisions. Men of science, as well as practical men, have since devoted time and money to the questions involved; and in less than five years we have witnessed international exhibitions, and congresses of all nations, devoted to the formulating and crystallizing, into language that shall have an understood and uniform meaning, the principles thus far established of this almost new department of science. The results accomplished are alike creditable to the energy, patience and skill of the various investigators who, coming from both sides of the Atlantic, and from various nations, have met with so much success in attaining their ends.

The result of this is that enough is now known to place the subject of the application of electro-motive force either for the production of *light*, or for use as a motive power, beyond the pale of conjecture, assertion or prospectuses. It is true, perhaps, that the relative economies of the different applications, as compared with those of other means, may not yet have been fully worked out in detail; but we are happy to state that, so far as lighting is

concerned, it has been undertaken under most favorable auspices in France, and that in time, no doubt, the results will be obtainable when the investigations shall have been completed.

As most of our readers are aware there are on the Continent of Europe a number of companies organized for the purpose of purchasing or leasing small works, and managing them under a single administration. Two of these companies in France are under the management of the well known engineer, Mr. Albert Ellissen, and with breadth of view and the readiness for acquiring positive information and facts, from careful study and investigation, which have always characterized his professional career as a gas engineer, he conceived the idea of establishing a laboratory equipped with all the needful appliances and apparatus for determining the question of the value of electro-motive force as generated by different forms of lamps, etc., for lighting purposes.

His idea was promptly seconded by some of the more progressive companies—of Lyons and Rome, the Imperiale and the Continental, Company Generale, the Company Madrilene, the Central Company, and the works of the Lyonaise group—who all joined in a handsome subscription to constitute a fund for the prosecution of the work. It is not expected that any results are to be obtained differing practically from what is already known in a general way; but it often happens that from some local cause it may be desirable to use the electric light. In such cases companies like those referred to above, whose operations are scattered all over the Continent, can much better afford to supply a demand for electric lighting than to allow anyone else to do it. The facilities which a gas company may have for doing a limited amount of such work may be better than those possessed by anyone else; and recognizing the fact that there should be no hostility between electric and gas lighting, but that they are merely co-ordinate branches of illumination, the true way to meet a demand is to know just how to supply it at the lowest cost. Such is the real object of the companies above-named in forming the "Association for the Study of Electricity."

The next thing was to secure the services of a competent, reliable, and skilled person to take charge of the laboratory and conduct the investigations, and in this the Association has been remarkably fortunate in securing the services of Mr. D. Monnier as its engineer. Probably there is no other gas engineer more thoroughly conversant with electricity, both as a science and in its practical application, and the laboratory which he has established is one of the most interesting that it has been our good fortune to visit. Of course the different makers of machines and lamps are only too glad of the opportunity to furnish them for the purpose of having them tested under perfectly reliable and impartial conditions.

Before beginning the investigations the following programme was submitted by Mr. Monnier, and approved by the committee having charge of the work—

The two questions which interest gas companies especially are the applications of electricity to lighting and to the transmission of force. Each of these should be studied from the double point of view of cost of production and the conditions of distribution and application.

To this end the first researches should be devoted to the generation of electricity, that is to say, to determine the quantity of mechanical work necessary to produce a determinate amount of electric energy with the different dynamo or magneto-electric machines.

The second part of the work should be devoted to the investigation of the utilization of electric energy, that is, to its transformation into work either luminous or mechanical, taking into account the distances to which they are carried.

These two series of determinations will furnish the elements for ascertaining the cost of production at the point of consumption, and enable one to determine the conditions upon which new undertakings might be made.

Among the numerous industrial applications of electricity, that of lighting presents the most immediate interest. We should then determine as exactly as possible, the quantity of energy necessary for the different types of burners in use of both the arc and incandescent variety in order to produce the light of one Carcel. This second part of the programme can be carried on at the same time as the first, as the study of each class of machine would naturally be best conducted in connection with the types of lamp that it was intended to operate.

The study of the transmission of electric force should follow that of lighting. This third part of the programme may be considered as one of the most interesting and most fruitful in an industrial point of view, because this mode of transmitting power is applicable in many cases where usual systems are not. After considering the subject of the generating and applying of electric force will come the subject of distribution by lines and branches, either directly or by intermediate secondary batteries, for we do not always know the exact requirements which these distributions must satisfy. This fourth head will include the study of the different systems of conductors to be employed according to circumstances.

The fifth and last chapter of the programme would be reserved to the subject of electro-chemistry, or such other applications of electricity as might interest the Association.

It will be seen by the above outline of operations that the investigations are undertaken in the broadest spirit of scientific enquiry, and that the object is simply to know the "bottom facts" of the business by a careful, impartial, and scientific investigation, and, knowing these, there is no doubt that the practical business men engaged will be well able to reduce matters to a business basis.

THE ELIMINATION OF TAR FROM THE GAS.

Notwithstanding all that has been said and written of late relative to hot scrubbing, frictional condensation, or hot condensation, as the process is capriciously termed by different writers, it is apparent from what has appeared in recent issues of the JOURNAL that interest in the subject is still maintained. One word right here relative to the different names given to this the newer method for removing the tar from the gas. There is no doubt but that this confusion in naming the work under consideration has given rise to a great deal of the misconception which, even at the present day, exists in regard to the nature of the process whereby the tar is eliminated without recourse to low temperatures. Nor is it difficult to trace out the cause which has led to so many names having been given to the work. For the idea that submitting the gas to a low temperature was the only means whereby the tar could be removed was held to so tenaciously, that the time at length arrived when the fallacy of the opinion pressed itself upon the attention of many contemporaneous workers. And so it was that many persons investigating the then phenomenon from different standpoints, and by various paths, and each meeting with more or less success, ascribed the effect produced to several agencies. Hence the confusion which exists in the appellations given to the work.

It is not necessary at this late day to dilate on the necessity of removing the tar from the gas completely prior to the arrival of the latter at the washers or scrubbers, so we can confine ourselves to the consideration of the best means for the attainment of the object in view.

Merely submitting the gas to a low temperature will not suffice, for unless the apparatus is very large in proportion to the work required of it, it will be found that the gas contains a large quantity of tar after it has passed the condensers.

If, then, we wish to remove all the tarry vapor, we must bring into play the potent force of friction. We say this deliberately. For be the tar scrubber of what form it may, it is safe to say that its efficiency will be in proportion to the extent advantage is taken of this agency. And as far as the mere removal of the tar is concerned it matters little whether the apparatus is run at a high or a low temperature. Here, then, is our first point, that the gas and tar are best separated by means of friction. And any departure in this matter should be in the direction of getting the most friction in the smallest machine. We said that as far as the removal of the tar was concerned temperature was of little moment. As a matter of fact the object to be aimed at is to remove the tar without impairing the quality of the gas, but rather to improve it if possible. It is here that the temperature at which a machine is run enters as a factor into the case; it is, however, difficult to assign to it a value. And the exact effect temperature has on the matter under consideration will not be positively known till the subject is exhaustively investigated. We are, however, assured of this—that if we keep tar and gas in contact at a temperature of about 200°F., some of the light hydrocarbons will be evolved from the former and the gas be enriched thereby. And, again, if we keep them together at a somewhat higher heat, a portion of the naphthaline in the tar will be vaporized and pass along with the gas. This is, though, carburetting the gas, and even if it carried on in the same apparatus that is used for removing the tar, the two processes should not be confounded. As it is a mode of enriching gas, it is open to the same objections that obtain in other systems of carburetting. Thus the brilliancy of the gas will be affected by variations in the quality of the tar or in the degree of heat at which the apparatus is maintained. Then, again, or perhaps more properly the same fact in a little different aspect, more naphthaline may be evolved than the gas can carry when, on the slightest disturbing cause arising, a troublesome deposit will result. Thus it is that some managers, not pausing to consider the necessity of keeping the temperature of a tar scrubber within certain limits, are bothered with this naphthaline bugbear. And doubtless the fact seems to them the more curious when they hear of other managers erecting similar apparatus for the express purpose of removing naphthaline. Trouble on this score might be obviated by not running the machine at too high a heat.

This is, however, but a part of the question, for we have not considered the effect produced when the tar and gas are kept at a moderate temperature, say 120°, or at a lower degree, say 60°F. The truth is the consideration of these two sections of the subject is rather difficult. We have cases on record where the tar and gas having been kept at a temperature of about 270° the gas has been enriched thereby, but frequent deposits of naphthaline have

also occurred, hence it was safe to reason as we did above; but when we come to take up the two remaining divisions of the case we find very few data at hand, therefore we must reason with caution.

True, laboratory experiments have been made which would seem to show that passing gas through the tar at a temperature of about 60° affects the gas injuriously, and, on gradually raising the heat, a point is reached where such deterioration ceases, and continuing in the same line, till a temperature of about 120° is touched, the gas is enriched. As, however, we fail to find in the records of any works where frictional scrubbing is used any corroborative evidence on these points, we cannot accept the experiments as conclusively proving the points in question. We know of cases where these apparatus have been placed after the condensers, so that the temperature therein has been about 60°F., sometimes falling lower, yet it has been impossible to discover any injurious effects produced thereby; and there are many works where frictional scrubbers are run at about 100 degrees to 120 degrees, yet if the gas has been improved by the process it has been of so slight a character as not to be clearly discernible. Hence it would seem that in practical everyday work, some factor or factors enter which considerably differ from the results obtained in the laboratory. But be this as it may, we know that no injurious effect is produced when the two substances are in contact at a temperature of from 100° to 200°. Further, when the apparatus is maintained between these points little trouble is occasioned by naphthaline. Now it would seem that this last desirable result could only be reached by one of two ways—either the tar removes the naphthaline, or else the gas absorbs some of the light naphthas from the tar and is so enabled to carry more of the naphthaline to the point of ignition. Possibly, both suppositions are correct, that at a temperature of 120° or thereabouts the surplus naphthaline is removed by the tar, and at, or near 200°, the gas taking up some of the light hydrocarbons, is thereby enabled to carry the naphthaline.

To recapitulate: Friction, it would seem, is the agency which should be made use of for eliminating tar from the gas, and the more correct, if not the most euphonious name for the process would be "The Elimination of Tar by Means of Friction." Further, while as far as the removal of the tar is concerned, temperature is of little importance, it is nevertheless wise to perform the work at about 200°, when a gain in illuminating power may be expected; and if the heat is run up much above this point, the gas will become surcharged with naphthaline giving a further increase in brilliancy, but also occasioning troublesome deposits. On the other hand, until it is known positively that contact of tar and gas, at a temperature of about 50° or 60° does no harm, it is prudent to separate them while hot and not allow them to meet again.

Improved Street Lighting in St. Louis, Mo.

The experiments which were made in improved street lighting in St. Louis, Mo., in the early part of October, 1881, and described by "Sag," in our issue of December 16th, of that year, are to be tried once more but on a much larger scale. The exhibition will commence on the night of Monday, October 2d, and continuing for the balance of the week. The method of operation is substantially as follows:

The line of illumination will be along the east and west sides of Fourth street from the south side of Washington avenue to the south side of Walnut street, a distance of 4,200 feet; thence along the north and south sides of Walnut street from Fourth to Fifth street, a distance of 860 feet; thence along the east and west sides of Fifth street from Walnut street to Washington avenue, a distance of 4,400 feet; while the St. Louis Gas Light Company will, at their own expense, fit up and illuminate the north and south sides of Olive street from Fourth to Sixth streets, a distance of 1,274 feet, as also their office building at 510 Olive street.

The plan of illumination is as follows: Beginning at the intersection of each curb line, standards, composed of two inch gas pipe, will be erected, each standard spaced eleven feet apart by nine feet high to a segment of an arch composed of one inch gas pipe with a rise of 18 inches in center; each alternate standard will be surmounted by a tree composed of nineteen burners; over the middle of the sidewalk will be trees composed of nineteen globes, each tree being twenty-two feet apart and alternating with trees along curb line. Olive street will have a double line of globes on each side of street; the standards will be surmounted by a tree fitted with nineteen burners; at the top the trees will be connected horizontally by a straight line of pipe, fitted with five globes between each tree and six feet above first line of globes; the top of each tree will be surmounted by a *fleur-de-lys*, making 54 burners every eleven feet.

The total number of burners, fitted with globes of variegated colors, will amount to 21,421; the lineal distance illuminated will be 10,754 feet. It will require 37,237 feet of pipe, not including laps and waste. Each section is leaded into the stone sidewalks in such a manner that it can be numbered, taken up and stored for future use. Each block is supplied by two two inch services direct from street mains, while at every crossing of streets will be sprung an arch 27 feet above center of street, fitted with 31 colored globes, making a total of 21 arches.

The St. Louis Gas Light Company is doing the entire work at less than cost price, and will donate the gas for the illumination free of charge for six nights, burning about five hours each night. The total amount of gas consumed will average 90,000 cubic feet per hour, 450,000 cubic feet per night, or 2,700,000 cubic feet for the week. The gas company, therefore gives the value of $225 per hour, the sum of $1,125 per night, and the neat little amount of $6,750 for the week, for the benefit of the city and the gas interest generally.

The Laclede Gas Light Co. also contribute 13 ponderous arches of about 300 burners each along Fifth street, from Washington avenue to Franklin avenue. From all this it would seem that, for one while at least, there will be "more light" in St. Louis.

[For the above particulars we are indebted to Messrs. Evens and Howard, of St. Louis, Mo.]

A Criticism on Some of the Opinions of Dr. Siemens.

The London *Journal of Gas Lighting*, in commenting editorially on Dr. Siemens's address (published in our last issue) makes the following remarks:

"It will have been observed that Dr. Siemens still clings to his old fancy of distilling gas of two qualities from the same retorts, and distributing the supplies for lighting and heating purposes through independent mains and services, This is the first point in regard to which practical gas engineers are at issue with him; and it may reasonably be supposed that many of the former, when they met with a repetition of the old idea in the recent address, were disposed to vent a few impatient remarks in connection therewith. Dr. Siemens has somewhat improved upon his older proposal, in suggesting that by the addition of steam to the poorer and latter portion of the gas taken from a charge of coal, the production of ammonia might be increased, and the volume of the gas swollen by the addition of a little water gas. In this way he says that the separate heating gas supply might be delivered at about one shilling per thousand feet. In all this string of suggestions, which might at least be taken to imply that gas engineers and managers do not at present know their own business, there is not the slightest evidence that Dr. Siemens has taken account of the practical difficulties and expenses of a second supply of heating gas which have been repeatedly urged upon his attention. He has formed an opinion, in our view quite unsupported by facts or arguments of any value, that to sell the two qualities of gas from the same coal, with all the extra expenses connected with the subdivision and double distribution, would be cheaper than the present practice of producing gas of one uniform quality, suitable for all purposes. This opinion is put forward with a certain air of authority, on all possible occasions; while it is patent to every experienced man that it contains a fundamental error that can easily be discovered by nearly everybody except Dr. Siemens.

"An incidental observation in the address—wherein the superiority of gas as a heating agent is accounted for on the grounds of 'the freedom of gas from earthy constituents, but chiefly to the heat imparted to it in effecting its distillation'—is too extraordinary to escape notice. It has always been considered that the superior economy of gaseous as compared with solid fuel, lay in the more perfect manner in which the mixture of air necessary for combustion can be effected with the former; and also in the more intimate contact with fire and the object to be heated. Any other considerations, such as those advanced by Dr. Siemens, besides those of more complete and economical combustion, are either far-fetched or totally insignificant. It is very strange that Dr. Siemens should have gone so far out of his way to find fanciful reasons for a fact which depends upon such simple causes.

"It was not to be expected that the chimera of making gas at the pit's mouth, and sending it to the point of consumption in long pipes, would escape mention in the address. As we have observed on a previous occasion, this is just one of those dazzling propositions which require to be discussed from a strictly practical standpoint. Dr. Siemens did not so treat it, but even made it more visionary than ever by his proposal to carbonize the coal at the bottom of the pits instead of at the top. Here again the responsibility for leading the public aright does not seem to have been properly grasped by the President, for we find him lending the weight of his authority to a scheme which a moment's reflection should be sufficient to condemn. Does Dr. Siemens know how it is that gas made at works within a stone's throw of the pits whence the coal is drawn is generally dearer than at Plymouth, some hundreds of miles further from the coal fields? If he or anybody else with similar notions will make inquiries into this matter, it will soon become plain to them that the cost of coal is only one of the smallest of many factors which influence the selling price of gas. It is the want of such knowledge that make these magnificent generalizations more misleading than instructive. In this matter, as in his duplicate distillation scheme, Dr. Siemens shows that he does not know the economic principles of gas supply and distribution."

[From the London "Journal of Gas Lighting."]

Some Remarks on Electricity and Petroleum as Competitors of Coal Gas.

A paper read by John Chew, Esq., at the meeting of the Gas Institute, Birmingham, England, Thursday, June 15, 1882, with the discussion thereon.

The remarks I have to offer to-day will be more of a practical than of a scientific character. In the first place, I have tried as much as possible to divest myself of the prejudices on this subject, which are common to gas men who have followed the business during the greater part of their lives. It is perhaps only natural that gas men should think that what they have so long considered the very best agent for the purpose of illlumination cannot be superseded by anything new. At any rate, they are not likely to become the first converts to new-fangled notions, but to be very conservative in their opinions, and reluctant to adopt the new faith in place of the old one. In fact, men who are "worth their salt" will not adopt it, until they have tried every means at their disposal to prove that their faith in the old ship is not without reason, and they will bring facts and arguments in support of it. To my mind, the most potent fact or test in this nineteenth century is that which will pay best, and is most convenient for public use. Men may talk and rant as much as they like, have as much newspaper puffing and advertising as they can afford, but it will be only like a flash in the pan. If the thing does not pay it will not do.

It is with a feeling of this kind that I am induced to offer these remarks to-day. I do not wish to overvalue coal gas as a lighting medium when put in competition with electricity or petroleum; nor, on the other hand, do I wish to undervalue the latter. To do so would be very unwise. I think, however, we should view the matter fairly all round, knowing as we all do the early history of gas lighting, and the difficulties it had to encounter in making its way in public estimation three quarters of a century ago. Most of us know so well what enormous sums of money were wasted before gas lighting began to pay, that we need not be surprised that in these days, when there is so much more wealth in the country, a portion of it should be freely spent in bringing electricity to greater perfection.

Speaking of electricity, if you ask what it is, all I can say is that you can not be told, any more than you learn what it is that gives the vital influence to the nervous system in human beings. We are sensible that it exists all through nature—in the air, in the earth, in water, and in human beings. We know that there are electric currents, and even electric storms or commotions, as there are storms of wind. In proof thereof I have only to point out to you how often you may read in the newspapers that a derangement has taken place in telegraphy, owing to the direction of the current being diverted by the prevalence of an electric storm in some particular district.

We know that in recent years great progress has been made in gathering, or, more properly speaking, diverting or generating electric currents, and using them for purposes of illumination, etc.; but we now safely say that we have almost reached the highest point of efficiency attainable in this department, as the generating machine gives out electro-motive force to within 10 per cent. of the power applied. I need not here describe an electric depot, nor how the current is, so to speak, made to do work and yield light as the result. Those of you who visited the Crystal Palace Exhibition are sufficiently well familiar with the gas and steam engines and boilers used, and the results given out. A little further on I may, however, give some particulars of the generating station fitted up by my department at Blackpool.

The various installations of electric lighting which have taken place in town and country up to the present time have been made with the conducting wires either overhead or underground. When wires are suspended in the air from poles or lamp-posts, they resemble telegraph lines, though they are much more dangerous should any happen to break while working. This fact alone will be detrimental to the adoption of all systems of overhead wires, and underground wires must of necessity take their place, inasmuch as you then have perfect immunity from danger to the public in the streets. The reason for employing overhead wires is not far to seek. It has been an endeavor to make the installation cost as little as possible. If the wires are to be laid underground, an expensive coating for insulation has to be resorted to; and to the cost of this has to be added the cost of the pipes and the laying of them in crowded thoroughfares. The price of a bare conductor will only be one-half or one-third that of a properly insulated one prepared for being laid underground.

Our first experience at Blackpool was with underground wires, to which the sea water percolated, dampening and rotting the light covering which had been placed over them, and which would otherwise have been sufficient, until the whole of the current became lost, or, technically speaking, "made earth."

It is now nearly three years since we obtained power from Parliament to spend a sum of £4,500 on electric lighting, with a provision that the whole was to be repaid back, by means of a sinking fund, in ten years. We have accordingly spent £3,500 of the amount named, and have for this sum a generating depot about 1,300 yards from the farthest light, with two 16-horse power (nominal) engines and boilers, with ten of Siemens's 6,000-candle machines, each of which absorbs about 4-horse power. From this depot are supplied the nine electric lights, the whole of which are said to be equal to 54,000-candle power when at their best. These are fixed about 60 feet high, in clear glass lanterns, having reflectors 4 feet in diameter, at distances varying from 180 to 400 yards. The wires are at present carried overhead, for the reasons before mentioned.

You will, I am sure, excuse me if I say that I have not myself seen, in London or elsewhere, anything to equal this lighting in brilliancy and effect. As the lamps are fixed in the center of the Esplanade fronting the Irish Sea, they are seen at distances ranging from 15 to 25 miles, and undoubtedly form a very charming attraction to our seaside watering-place. We have not adopted these lights with the object of saving on the cost of gas, but rather with a view of keeping our town in the front rank of watering-places. The Corporation are not at all sparing in the use of gas, for in our 20 miles of streets we have 650 gas lamps, including 30 or 40 of Bray's and Sugg's of from 60 to 100 candle power.

I will shortly give you the working charges for our electric plant, with a view to making some comparisons as to how the electric light may compete with gas; but the difficulty in which I find myself is to tell accurately the photometric power of the lights, as so many different estimates are made by different makers. Taking, for instance, the lighting of the city of London, and comparing the Brush and Siemens systems, the lamps of the former are put forth as being of 2,000-candle power, and those of the latter as being of 300 to 400 candles only; yet, to an observer, it is difficult to see which gives the best illumination, though the contrast ought to be as striking as it would be between a street lighted by ordinary gas lamps and one lighted by the improved lamps of 100-candle power.

During the year ending March last we worked our lights for 25 weeks of seven nights each, or a total of 175 nights, being equal to 600 hours. The cost of this was as follows:

Wages	£179	15	0
Coke, water, and gas	63	19	2
Oil, waste, tallow	6	3	11
Carbons	51	0	3
Ground rent	15	0	0
Tradesmen's account for materials for the repair of lanterns, engines, machines, wires, insulators, posts, and paint	125	11	9
Total	£341	10	1

The above charges are different from those of the previous year by about £20, arising from our having had to renew two of the high poles; so that we may safely say that the working and maintenance charges are a fair average for the two years', or rather two seasons' working. The total of the expenses, less interest, being £441 10s. 1d., and the number of hours being 600, this is equal to 14s. 8d. per hour; to which must be added interest at, say, 5 per cent., amounting to £175, or equal to 5s. 10d. per hour. As, however, only the same interest would be payable if the lights were burning a greater number of hours—or, for the purpose of comparison, say 1,800 hours, which is the number of hours our gas lamps are in use—this would then reduce the rate to 2s. per hour, instead of 6s.; therefore the total cost would be 16s. 8d. per hour for sustaining what is called 54,000 candle illuminating power.

The next point is to consider whether there is 54,000 candle power, and to get an approximate idea of what illuminating power each light actually possesses. I lately made a test of one of the electric lights, against one of Bray's 60-candle gas lamps, which happens to be situated at a convenient distance from and in a direct line with the light, and the result was that the average illuminating power was about 3,000 candles, or at the rate of 750 candles per horse power, which was as near as I could ascertain with the rough apparatus at my disposal. Owing to the color of the light, the ordinary disc photometer could not be used, and I had to arrange for throwing a direct shadow upon a white ground. The light from the arc is so variable at times, although it is scarcely perceptible to the ordinary eye, that it was with difficulty that I could tell for any length of time the exact position for the meeting point. I have no doubt, however, that if the electric light had been on the ground, and under control for the fine adjustment of the arc during the test, a much higher result might have been attained; but this may be taken as a working test, though it is possible to get 1,500 candles per horse power in experiment.

I will now put this result in comparison with coal gas, which in Blackpool is produced of from 18 to 20 candle power, and sold at 3s. 3d. per 1,000 cubic feet. But if the Corporation were content with 5 per cent. interest only, it could be sold at 2s. 3d. per 1,000 cubic feet; and seeing that I have put the

electric light at this rate of interest, it is only fair that I should put gas at the same rate. This would work out as follows:

To produce gas light of 27,000-candle power, which will be that produced by the nine electric lights, would require, say, 27 gas lamps, each of 1,000 candle power. These would consume 7,500 cubic feet of 18-candle gas per hour, which at 2s. 3d. per 1,000 feet would be equal to 16s. 10d. To this must be added the cost of cleaning, lighting, and repairs, at, say, 30s. per lamp for 1,800 hours, which on 27 lamps is equal to £40, or at the rate of 5s. 3d. per hour; making a total of 17s. 3d. as the cost of gas against 16s. 8d. for electricity, or a difference in favor of electricity of 7d. per hour.

You will see, then, that for large lights, such as those we use, electricity apparently would cost less; but it has the disadvantage of being a concentrated light, and cannot as yet be economically divided into small ones. A light of the power we use is too large for ordinary lighting, as you cannot obtain from it its full advantage.

To divide this light of 27,000-candle power into incandescent lamps, so as to make them suitable for houses and streets, a very much larger outlay of capital would be required for plant to produce the same lights. If we were to use our own apparatus—that is to say, the engines and dynamo machines—as a generating station for the production of incandescent lights, we should have, from the 40-horse power developed, and the generating machines at the rate of ten 16-candle lights for each horse power, equal to 400 lights for the whole of the total power of 6,400 candles, instead of the 27,000 we get from the arc lights. This is not one-fourth part of the amount of light we obtain from the arc system, taking the latter at half the amount stated by the makers of the appliances, and the incandescent light at the full value stated by them. What it would be if we had generating stations distributed about the town, and conducting wires laid in the streets, I could not even guess.

It was recently given in evidence by Dr. Siemens, before the Parliamentary Committee on the Board of Trade Electric Lighting Bill, that to supply 2,000-horse power value of light would require a capital of £100,000. This amount, worked out at the usual rate of ten lights per horse power, each 16-candle power, would give a total of 320,000 candles; being at the rate of 6s. 3d. per candle. However, Mr. Johnson, the agent of the Edison Company, gave 33,000 lights of 10-candle power, or 330,000 candles, for £100,000, which will be found to work out to a little more than 6s. per candle. Applying the same figures to our own apparatus as above stated, the capital works out to 10s. 11d. per candle.

Certainly electric lighting seems very far from being within the range of practicability at present, notwithstanding all the advances it has made within the last three years.

A great deal has been said about gas engines being made the motive power for driving the generators, and about this being the most economical method of applying it. Perhaps it is; but those who have bought good gas engines know that there is not much, if anything, gained in the outlay, in the first instance, between the cost of them and an engine and boiler worked by steam. The gain would be in superintendence. Who are the people likely to use the incandescent light in their houses? The most wealthy, to whom money is not an object. It will never do, however, to set up works to supply only the wealthy in a community. When the Electric Lighting Bill has passed through committee, I trust the responsibility of maintaining a supply of gas will not be enforced by the Legislature. Where an electric light company competes with a gas company let both have a fair field, under the same conditions, and no favor; then the old doctrine of the survival of the fittest will put one or other into its proper place.

I am not at all surprised that the Brush Company and its offshoots declare very large dividends, and that their shares command so great a premium. I do not see that they are doing much beyond acting as makers of a special class of machines in which they have a monopoly. As long as the public will buy their apparatus at present prices, this will continue. The district they light in London is the best and cheapest advertisement they could have. The "tall talk" of this Company, and that of Hammond & Co., just floated, surpasses anything I have read out of America. If anyone will read the speech delivered by Mr. Hammond at the Cannon Street Hotel, on the 18th of May, at a sort of statutory meeting of the Hammond Company, he will be treated to such a specimen of brag and bunkum that I should have thought no body of commercial men could have digested.

People are investing their money now in these electric light companies as they have often done before in South American stocks, Turkish bonds, lead mines, and "salted" gold and silver mines. From the last return I have seen, from January to May, 20 electric light companies have been registered with authorized capitals amounting to over £9,000,000 sterling. This certainly indicates that there is more capital in the market than can be employed in legitimate trade, and seeing that there is no fair opening that promises a profit, it must be recklessly employed to blow out a large number of bubble companies that will never exist anywhere but on paper and as a medium for share speculation.

Speaking of the electric light as it is, one would suppose that people think no improvement tending in the direction of reduced prices for gas is possible. I must differ largely from this opinion. If the capitals of so many companies and corporations can only be brought to bear a rate of interest that is now ruling the money market, it will not be one town alone that will supply gas at 1s. 9d. per thousand cubic feet, with 5 per cent. interest on capital expended, and nothing taken off the price to go in relief of rates, and new and improved apparatus erected at a less cost than formerly; and although great improvements may hereafter take place in the supply of electricity, there is plenty of room for it before it will be able at all to compete with coal gas. So far as it has gone it has benefited the suppliers of gas by calling into requisition a need for a greater quantity of light, and, as a result, more gas and more capital at a low rate.

I am willing to concede that many shareholders who have become possessed, by purchase or otherwise, of 10 per cent. stock, for which they have paid a price that will only yield 5 per cent.—particularly if it be in companies with inflated capitals and high-priced gas—are likely to suffer; as also will corporations who have bought too dearly be deceived in expecting to relieve the rates by their purchase. But we, as a body of gas engineers, are bound to do everything in our power to produce a cheap quality of gas suited for all the various uses to which it will be hereafter applied, and, in so doing, fear no competition from electricity, as it will stimulate us by healthy competition to push on to still greater improvements than any we have made in the past.

When I undertook to write the present paper I thought it would be advisable to say something about petroleum as a competitor of coal gas. I think the subject worthy of some attention at our hands, for there can be no doubt whatever that in many small towns in the country petroleum is a much more formidable competitor of coal gas than electricity, especially in the houses of the working classes. But perhaps I had better give you some particulars of my own experience in its use for street lighting purposes, seeing that during the whole of the past winter I used it for the supply of more than 50 lamps in a portion of our district in which we had not the power to supply gas.

This part of our district was added to the borough about three years ago, and was quite rural in its character, and not likely to have 50 consumers for the next ten years to come; but we found a particular portion of the district had been annexed by a small gas company some five miles away. There was nothing but farmhouses on the road for this distance, and the company had not laid any pipes up to that time, and what we considered a fair offer of compensation was made to them to surrender their right to supply gas, but they declined. Since then we have not been able to agree to any terms, and have therefore set up lamp-posts every 50 yards through the whole of the village, fitting up the posts and lanterns. Several kinds of petroleum lamps were tested for the purpose, and ultimately I decided to recommend the Silber Light Company's street lamps.

As I go on I will give you the figures as to the cost of this undertaking for lighting during the past winter; the period of the cost to which I am about to refer being from Oct. 30 to April 30—six months. The lamps were lighted shortly after sunset, and put out at twelve o'clock at night, and left out altogether for five or six nights about the time of full moon each month. The total number of hours during which they were alight was 962. The illuminating power of each light was equal to 10 or 12 candles, and I may say that the lamps have been very satisfactory to the people for whose benefit they were put up. You must not suppose by this remark that I consider them equal to gas lamps; but on account of their being oil lamps they were placed closer together than gas lamps usually are. In small country villages from 70 to 100 yards, or even more, is not an uncommon distance for gas lamps to be placed apart, even when 14 or 15-candle gas is supplied.

After the first month or two, when we had removed certain little defects here and there, I did not have anything like the trouble I had anticipated with the petroleum lamps. Too much or too little air getting access to the lanterns would sometimes make them smoke, and at other times cause them to be blown out. The result was that I found they required twice the amount of labor and attendance in lighting, keeping clean, and trimming, than an ordinary gas lamp does; but having made up my mind that they should succeed, the cost of extra labor did not deter me from going on with them.

After making the closest inquiry, I find that out of the 54 lamps we had in use, it was very seldom that there were more than two or three out, or even doing badly, on any one night. Had I not made this experiment myself, I should have doubted very much that they would have done so well as they did; but having now tried it, I feel sure that, whether it be on the score of expense or the quality of the light, oil is a dangerous competitor with coal gas for street lighting in any small country village where gas is both dear and of poor quality.

The details of the expenditure in connection with the petroleum lamps are as follows:

Outlay in capital account for 54 posts, fitted with lanterns and Silber oil lamps complete	£156	8	0
Expenditure for cleaning, lighting, and repairing	£49	7	2
Petroleum oil	22	6	11
Six months' interest on capital, at 10 per cent	7	16	0
Total	£79	10	1

This works out pretty nearly to 0.37d. per hour for each lamp. The oil I used was of different prices. At first I thought I would get the highest, "Water White" brand. This was 1s. 4d. per gallon for casks; but I found this to be no better than the quality I am now using. It is what is known as the "Royal Daylight" brand. For this I gave 11½d. per gallon, but it is offering for very much less—in fact as low as 8d. per gallon in casks—and it may be bought retail at 3½d. per quart, or 1s. 2d. per gallon. The price of course varies with the season of the year; but I have given the highest and lowest prices at which I have bought.

In judging of oil as a competitor with gas, this broad fact meets you—that a good oil lamp of the best make (we give 11s. 6d. each for ours) will give a light, taken roughly, of 10 to 11-candle power, and consume in 20 hours one quart of oil, costing 3½d. at the retail price; whereas 100 cubic feet of coal gas, costing 5d. at 4s. 2d. per 1,000 cubic feet in country towns, will give a light for 20 hours of from 14 to 16-candle power. I have given these latter figures of quality and price as perhaps a fair average in each case. I had not the means at my disposal for testing the exact photometrical value of the kind of lamp I use (the size and make being inconvenient for placing it in the bar photometer) except in a very rough way; but I tested it sufficiently near for practical purposes.

When we consider the foregoing facts, it is not to be wondered at that the workman and cottager use oil instead of gas, when it is brought like milk to his door, and retailed in the smallest quantities. He cares nothing about the slight smell it gives off, and the trouble of trimming his lamp is not of much account when his hands are soiled with his day's work. A good lamp for a workman can be bought for 1s. 6d., and this is all he requires. Under these circumstances he will not trouble the gas company much, and for myself I can safely say that I do not regret it; for the collection of accounts from this class of customers, the trouble of inspection, and removals from house to house, the turning on and off of the gas for every change of tenancy, the taking and repayment of deposits, with the allowance of interest at 5 per cent. we are compelled to give, cause no end of trouble and expense, which is scarcely compensated for unless consumers are charged a higher price for what they bring to the rent-roll.

DISCUSSION.

Mr. F. T. Linton (Leith) said that, having recently tested a Siemens regenerative burner specially adapted for gas of the quality supplied to Edinburgh—24 to 28-candle power—the result gave about 8¾ candles per cubic foot of gas. Working this out at the present price of gas in Edinburgh, it gave a light of 1,000 candles for rather less than 4d. per hour; or, taking Mr. Chew's estimate of 16s. and some odd pence per hour for electric lighting estimated to be equal to 27,000 candles, the cost of an equal light with Edinburgh and Leith gas, in the Siemens burner, would be only 8s. 8d. per hour.

Mr. C. E. Jones (Chesterfield) said he was unable to agree with some of the conclusions at which Mr. Chew had arrived. In the early part of his observations he told the members to divest themselves of prejudice, and to endeavor to follow in the wake of electricity; but he (Mr. Jones) did not think this remark was a just one, as it partook of the character of a reflection upon gas managers. They were not at all a prejudiced body. They were ever willing to welcome any improvements that at all affected the public weal. He thought exceptional indulgence had been shown to electricity—far more than had been shown to gas, even after an existence of half a century. There was a great future for electricity, but he did not think it would be in the lighting department, where coal gas would always hold its own, if paid for on equal terms, because they could produce a far better result for the same money. He had seen the lighting at Blackpool, and agreed that it was the best specimen of the electric light he had seen, though he was strongly convinced that the Siemens gas lamps would produce a much more pleasant, if not so striking an effect. Another point with regard to the cost was whether the Blackpool Corporation had paid any rates upon their expenditure for electricity, because his company, out of every 1,000 feet of gas they sold, had to hand over 6½d. to the rate collector. He would also ask whether it was not desirable to lay the electric wires, as was done by the post office authorities, in cast iron pipes underground. He knew a town where the electric wires were hung overhead; and they were so low that a fire escape could not be driven along the street without lowering it to pass underneath the wires. If the wires were laid in pipes underground it would rather increase the capital account. Mr. Chew had drawn comparisons between the cost of gas and electricity, and seemed inclined to favor his "new love" to some extent. He was not surprised at this; but, he asked, was it not the fact that the Corporation of Blackpool had spared no trouble or expense, and that the electricity was used very much as a kind of a decoy-duck to tourists? Mr. Chew had described with some force an electric lighting company which talked a great deal of "bunkum;" but it appeared to him that the Corporation of Blackpool were somewhat in the same position. There was in electricity one disadvantage which was not even overcome at Blackpool, and that was the variability of the arc light. Mr. Chew said he measured it, and gave the definite quality in candles at 750; but said at times it would be 1,500 candles. This was a considerable variation. He (Mr. Jones) did not know any photometer that would not detect something within these limits; and he thought the result was so extraordinary that he hoped Mr. Chew would give them something a little more definite. He some time ago tried the experiment of putting up in a large square a Wigham burner, the illuminating power of which was claimed to be 1,000 candles. It was not burning under the most favorable conditions; but the signboards and names around the square could be read as clearly as if the sun was shining upon them. At the present moment, upon the very same spot where the Wigham gas lamp was, there was an electric lamp which was said to be of enormous illuminating power—something like four times as much as the Wigham burner; but the letters round the square could not be read as with the gas lamp. This was a practical illustration which he had learned in photometry. He would not go into questions of legislation, but he might say he did not think gas companies were treated as fairly as they deserved to be by Parliament, which was too favorable to electricians, especially considering that gas companies had fulfilled all their statutory obligations. They could not help drawing some comparison between electricity and gas. Gas possessed the following good qualities—viz., cheapness, constancy, penetrating power, and diffusibility. He had had an opportunity, in the brilliantly illuminated town he had just left, of seeing the electric light in a fog; the town lay in a vale, and heavy fogs at times settled over the vale. He had gone out in a fog, taking the precaution to carry a lamp with him to find the electric light, and was nearly knocked down by a vehicle driving along the road. He had to tell the driver where he was, and that was within 50 yards of a large Brush electric light. Then the diffusibility of the gas was greater, which was due, as has been pointed out by Mr. Sugg on the previous day, to the presence of the red rays instead of violet ones. Dr. Siemens had just been in his (Mr. Jones's) neighborhood, as well as at Blackpool, and, he believed, had attained very excellent results with electricity at Sheffield; and he hoped he would, with his accustomed generosity and fairness, give the meeting some idea of the cost of the experiment at the latter place. It was stated that the power of distinguishing colors with the same facility as in daylight was afforded by the electric light; but he was told that this was not universally true. Electricity was called "the light of the future;" and it was quite true it was not the light of the present. With regard to petroleum, he agreed with Mr. Chew that they had more to fear from its competition than from that of electricity. Petroleum was the light of the poor, for good oil was now sold at less than 1s. a gallon; but he did not think it would be any cheaper, because the demand appeared to be increasing, and he rather thought it would become dearer. He would remark, in conclusion, that in his town there were 28 or 30 petroleum street lamps; but petroleum possessed explosive properties, and was regarded with considerable suspicion by miners and others. He had known more than one lamp explode, and the oil run from it on to the street and take fire, which would be rather awkward if anyone were underneath.

Mr. C. E. Botley (Wormwood Scrubs) said it did not do to depreciate the value of the electric light. No doubt there were uses for it; but it was not in places where gas was possible, but rather in special cases. They would not have heard so much about the electric light if it had not been bolstered up by fallacious and misleading newspaper articles, and by unscrupulous statements made by some electricians. With regard to the cost of installations, from estimates he had seen connected with the Brush light, which was the cheapest, it might be taken roughly at £100 per lamp; and after this the cost of maintenance, exclusive of interest on capital, was about three times the cost of gas at 3s. per 1,000 cubic feet. With regard to the candle power, a great mistake was made in saying the electric lamp was of so many candles power, and gas only of so many; therefore a fallacious comparison was made in favor of electricity. The value of any light was the duty it did as an illuminant, and not its concentrated power. Taking it in this way, he had made an experiment by placing a 100-candle Sugg lamp, consuming 27 cubic feet of gas per hour, between two Brush lamps, which were 30 yards apart, and it completely swamped the electric light where the rays crossed. If anyone looked at the electric light itself, its brilliancy and its white light made it appear stronger; but when one looked on the ground to see the work the light was doing, the yellow rays of the gas completely covered the rays produced by the electric lamps, and seemed to give body and warmth to the electric light rays. With regard to petroleum, he had seen that its use was considerably increasing in the East. The Arabs procured any com-

mon bottle, put a piece of tin through the cork, and a bit of cotton through it, and lighted it, and he had seen these lamps in all the bazaars. Its use was spreading greatly in North Africa, and he really thought petroleum was a competitor they had to fear much more than electricity,

Mr. Cleland (Liverpool) wished to know if a certain amount of gas, say 1,000 feet, were used to run a gas engine, which was employed to turn a dynamo-electric machine, what proportion the electric light produced would bear to the illuminating power of the gas consumed to move the engine.

Mr. Jones said he had omitted to ask Mr. Chew whether the cost of the incandescent lamp he recommended was not something like eight times the cost of the arc light.

Dr. Siemens said he had not come prepared to make any remarks upon the paper, but as he had been referred to, he might say that he could agree with a great many of the points which had been insisted on by the author, though he must beg leave to differ from him on some others. He thought gas lighting never had a better friend than electric lighting, and if he had ever any doubt with regard to the matter, the present meeting would have removed it. The disposition there appeared to be amongst gas engineers, not to shut their eyes to this competitive system, but to examine into its merits and demerits, was the best proof that they were on the road to improved results, let them come from whatever quarter they might. With regard to the relative cost of gas and electricity, he had considered the matter a good deal, and, in answer to Mr. Cleland's question, he might say that if so many feet of gas were put into a gas engine, and the power from it taken to produce an incandescent light; and, thirdly, if the same amount of gas were burnt in a standard burner—the proportion, as nearly as he could make it out would be as follows: 40-candle power in the gas burner, 50 in the incandescent light, and 400 in the arc light. These were the figures resulting from that comparison; but it would be wrong to say that it was therefore advantageous not to burn gas except in the cylinder of an engine, because in the case of the burner one only had to light the gas, whereas in the other cases the gas engine had to be procured and worked, and the dynamo machine and electric lamps provided—all involving expenditure and attention. There were advantages, however in favor of the electric light, which should never be overlooked. His own dining-room and drawing-room were lighted by incandescent lights, and he did not intend to make a change, because when he had a number of friends sitting with him around the dinner table they found the air much less oppressive, and the air much less heated than it would be if gas were employed. The incandescent electric light, although it might be much more expensive than gas, would make its way notwithstanding all opposition, for it was a light of luxury, and on that ground, amongst others, he thoroughly agreed with the propriety of giving free scope to the introduction of the electric light into towns. But what had been the immediate result of lighting his own dining-room by means of the incandescent light? When his visitors went up to the drawing-room it was like entering into darkness—the candles and oil lamps were not nearly sufficient to supply the amount of light which the incandescent lamps had furnished, and the drawing-room had to be lighted in the same way. For a similar reason the light employed in the passages, and, in fact, throughout the house, from the kitchen to the garret, appeared comparatively dark by contrast; and considering that for these applications the advantages peculiar to the electric light did not apply, an increase of gas consumption would be the result. There were other applications of the electric light on a large scale—in docks and harbors, for instance, it was a very advantageous form of lighting; and although he believed that gas lights would be intensified so as to produce a large body of light from an elevated point, yet the electric light was extremely well suited for such use. For military purposes also it was advantageous, enabling one, by the aid of the holophote or parabolic reflector, to observe the movements of an enemy. In warehouses and works of some descriptions, and crowded halls (like theaters) he believed the electric light was pre-eminently in the right place. Gas, while still holding its own for illumination, should look for its chief application, however, to its advantages as a heating agent. He was very glad to see that in some towns this matter was receiving close attention, and he had no doubt that if heating gas were introduced systematically, on fair commercial principles, its consumption would be something extraordinary. There was in the paper one remark which took him by surprise, where the author said that gas would be employed everywhere but in the dwellings of the poor. Now he was of opinion that gas was particularly the poor man's friend, both for lighting and heating. The reason given for its non-use was the difficulty of collecting payments; but this suggested to his mind, not the use of petroleum in the cottages of the poor, but, on the contrary, the desirability of introducing gas. There might be some little difficulty experienced in collecting the rents; but he should consider that for a poor man to have to go and buy threepennyworth of petroleum, to be burnt in an inefficient manner in a badly constructed or leaky lamp, and to emit, both by burning and spilling, smells which made the cottage a loathsome place, was a condition of things that ought not to be at all encouraged. If the charge for the gas were made against the cottage, the gas company would be sure to get their due in the end, with the rates; and, in the meantime, the tenant would be ensured a light which was cheerful, did not cause any smell, and gave moreover the effect of warmth, which, while an objection to its use by the rich, was a great advantage to the poor. It could, moreover, at any time be called into requisition as a heating agent, to heat a kettle, and save coal when it was not cold enough to light a fire. He hoped the gas companies of this country would not, therefore, from such conditions as had been stated, discourage the use of gas by the poor.

Mr. C. Gandon (Sydenham) said it was a very general custom to reproach gas as being objectionable on account of the heat; and Dr. Siemens had advocated the lighting of dining-rooms and drawing-rooms by the incandescent light on the ground that it ensured a pure atmosphere. He was not sure that the warmth given out by gas lights was not sometimes an advantage; but, apart from this, it was perfectly practicable, where it was desired, to use gas lamps in such a manner that all the products of combustion were carried away. This was a point which could not be too strongly impressed, not only on gas managers, but on the public generally. An admirable illustration of this had been given on the previous day, in the case of the Reading Town Hall; and there was no reason why, by that or other means, private dwellings should not be freed from the ill effects of the products of combustion, and ventilation effected at the same time, which could not be done by electricity.

Mr. Chew, in reply, said he had not been desirous of overestimating or underestimating the power of the electric light. The 6,000-candle lamps of Messrs. Siemens at Blackpool *often* gave fully 6,000 candles illuminating power, and he would explain how he ascertained this. He had not the means at his disposal that Mr. Sugg had when making the comparisons which he mentioned on the previous day, but everyone knew that a light was powerful in proportion to the distance that it covered. If the quantity of light covering the area all round a lamp were measured, and then another light in another direction were measured, the two could be compared. The way in which he did it was this: He took a large flat black surface, and on this he put a white disc. The 60-candle lamp he had been speaking of, consuming 15 feet of gas per hour, was placed so many yards away from the electric light, and adjusted until the shadows were equal on the disc. The yellow shade of the gas and the blue shade of the electric light were compared, and the apparatus was moved until they were both blended together, as was done in an ordinary photometer. When he said they varied from moment to moment, of course, in measuring a 6,000-candle light, if a small piece of carbon came off it varied the intensity for a moment. Sometimes the carbons were not perfect, and sometimes they were; and when the latter was the case a far superior light was obtained. Since the electric lights had been introduced many little difficulties had been overcome, and a much steadier light was now the general rule. He did not wish particularly to refer to Dr. Siemens's firm; but it was his opinion (and that of others not influenced by prejudice) that Dr. Siemens's dynamo machine was the best generator of electricity at present in the market. With regard to Mr. Jones's remarks, he could only say that gas men were very much like other human beings, and therefore were not free from prejudice. His friends at home told him that his prejudice was strongly pronounced in favor of gas, and now Mr. Jones accused him of being prejudiced in favor of electricity. Mr. Jones also asked if rates were paid for the electric light. His answer was that the Blackpool Corporation had the capital to pay back in ten years, and it was done by rates; but he did not include this in the estimate, because it would have been unfair. The ratepayers burdened themselves to the extent of 1½d. in the pound to put the electric light on the Blackpool Promenade. The wires were not laid underground because of the expense. If they looked at the Edison lights on the Holborn Viaduct they would see that the very small wires brought up to the street lamps were cased round like a submarine cable; and the expense of putting the wires underground led them to abandon that plan and put them overhead; but he believed that no such system would ever be tolerated in the future. The really weak point in the incandescent system was the immense outlay required on capital account, which was five or six times that required for the arc light. Dr. Siemens seemed to think he was averse to lighting the cottages of the poor by gas. This was a mistake; but if Dr. Siemens had had his (Mr. Chew's) experience in collecting gas rents among the poor, he would agree with him that if it were not for exacting deposits, or landlord's guarantees, one-half the gas supplied to houses let on weekly tenancies would not be paid for. It might be that in the time to come, when the City of Hygeia was founded, the habitations of the poor would all be lighted by gas, as Dr. Siemens suggested, while those of the rich, who were disposed to enjoy the luxury of electricity, would have the "light of the future."

Fuel Gas in St. Louis.—St. Louis is to be supplied with water gas for fuel purposes, made by the Lowe process. The laying of pipes is progressing, with ten miles under contract.

Tar Roofs.

The London *Builder* says that the German government has on several occasions pointed out to farmers and others interested in agriculture that too great an expenditure of capital on buildings is a mistake. With a view of illustrating the application of this principle of economy to roofing, the *Cologne Gazette* points out that the system of using tar for roofing purposes is at the same time economical and suitable for agricultural buildings, and what is said may serve as an answer to a recent inquiry in our own pages. The framework of the roof can be of relatively slight construction on account of the nature of the covering it is intended to support, and the perpendicular height of the roof can be one-eighth to one-tenth of the entire depth of the building. The distance of the rafters is arranged according to the width of the covering material, the scale being that from the middle of one rafter to the middle of another. The distance should be 2⅜ in. less than the width of tar roofing sheets.

Immediately upon the rafters come boards, and upon these (exactly in the center of the separate rafters) are placed strong laths, about 2 in. wide and 1⅜ in. thick, the upper edges being taken off. The roofing sheets are now placed so as to cover the spaces between the laths, and are nailed. Over the laths are placed strips of paper, 5 in. to 6 in. wide, fastened with nails at intervals of 2⅜ in.

In order to make the sheets lie smoothly upon the boarding, it is suggested, in case they are too dry, to soften them by immersion in water. It is recommended that the workmen should not wear heavy-nailed boots, and also that if the rain comes on, the roof should not be walked upon immediately after. When the entire surface of the roof is covered with sheets, the strips of paper (or caps) already named, as well as the joints, are painted over with a hot mixture of coal tar and pulverized lime. Pure dry sand is at once sprinkled over this coating, and particular care must be taken that all the nail-heads are well covered. When the paint is dry the whole surface of the roof is once more coated with the same mixture, and is sanded.

The object of this careful method of overlaying the roof with several coatings of specially prepared solutions is to preserve in the tar those oleaginous and fatty properties which it soon looses if exposed to the air, and the retention of which is an indispensable condition of its resistance to water. Clay and sand do not afford sufficient protection, and they are removed by violent winds.

Reference is made to various systems of coating the tar roof with protective substances, for the purpose indicated. One of the most successful methods consists of a mixture of cow dung and thin white lime, which is spread over the entire surface of the roof. If such a coating is not applied the tar paint must, during the first four years, be annually renewed, which enhances the cost of the roof. If the last-named protective composition is used, and renewed every two years, the coating of tar and lime can be dispensed with. Particular mention is, however, made of a coating of tar mixed with Portland cement, the tar being well heated and used in the proportion of 111 pounds to 200 pounds of cement. The mixture should be kept well stirred during the preparation, and should be applied as soon as made. This particular method has been tried in many cases in Germany, and, according to the journal quoted from, its satisfactory results have caused its adoption upon a scale of progressive importance.

Breeze and Dry Lime for Purifying Gas.

Mr. F. A. Sabatton, of Troy, N. Y., writes us that in looking over some old papers he found a circular, issued in 1851, setting forth the advantages to be derived from the use of "coke dust or breeze, in combination with dry lime, for the better and more economical purification of gas," letters patent for which were granted to Jos. A. Sabbaton on July 12, 1850, and numbered 7,534.

A late number of the London *Journal of Gas Lighting* makes mention that a patent has been issued in England to a Mr. Walker for the same thing, and it will be remembered that Mr. Somerville, in our issue of September 2d, states that, ten years ago, he employed the same process, and did not think it worth his while to patent the idea, seeing neither originality nor great merit in the scheme.

The claim in the *Journal of Gas Lighting* of July 18th, of a saving of 25 per cent. of lime at the South Metropolitan works and elsewhere, as asserted was found by practical test of its use, would seem to be a confirmation of the results obtained by Mr. Thos. R. Dutton, at Hartford, Conn., in 1851, as will be seen by his letter embodied in the circular as given below:

"Circular to Gas Light Companies."

"The subscribers would respectfully call the attention of gas companies to their improved method for purifying coal gas, for which letters patent have been obtained. By reference to the following extract from the specification of the patent, the mode of operation will be readily understood, and the certificates on the next page will show the estimation of its value by the different gas works which are now using it.

"Communications addressed to either of the undersigned will receive prompt attention.

"Jos. A. Sabbaton, Gas Works, Washington, D. C.
"R. Merrifield, Gas Works, Albany, N. Y."

"*Extract from Specification of Jos. A. Sabbatton's Improvement for Purifying Coal Gas.*"

"My improvement consists in: that instead of using lime alone, I use a mixture of lime and coke dust, technically called "Breeze," an article now thrown away as useless; or in its stead charcoal dust, or any other substance of that nature, the object being thereby to produce a separation of the particles of lime, by which means a greater number of them are exposed to the action of the gas, and besides this mechanical action the carbonaceous matter exerts a chemical action on the ammonia and other impurities contained in the gas, and separates them from it; and I have ascertained from experiment on a large scale, and during several months' practice, that from one-half to two-thirds more gas can be purified by the mixture than when lime alone is used, thereby making a proportional saving in the quantity of lime used. It also lessens the pressure upon the retorts by reason of the mixture not offering so great a resistance to the gas as the solid body of hydrate of lime when used alone; consequently the accumulation of the carbonaceous deposit in the retorts will not be so rapid nor so great, which will cause them to last for a longer time.

"I do not confine myself to any definite proportion in the quantity of ingredients in the mixture, as that will in a great measure depend upon the quality of the coal from which the gas is obtained, and must be tested by experiment; nor to the precise nature of the ingredient mixed with the lime, as other carbonaceous substances than those I have named may answer equally well. But I prefer using coke dust, or breeze, which is to be sifted through seives having meshes not larger than one-quarter of an inch square, and I prefer, as a general rule, to use one bushel of the breeze thus sifted with one bushel of lime, both to be intimately mixed together, and brought to the same state of moisture as the lime is in the ordinary way. When thus prepared the same quantity of the mixture is used on the tiers or shelves as when lime alone is used, and to be laid on the usual depth. The breeze which I use has a chemical affinity for the ammonia held by the gas in its passage through the the purifiers. It is then taken up by the mixture and a purer gas is evolved from the purifiers than when lime alone is used."

"*Certificates.*"

"Office Charleston Gas Light Co.,
September 23, 1850.

"Joseph A. Sabbaton, Esq., Albany, N. Y.:

"Dear Sir:—Please find above Bank of Charleston check, No. 1,609, of this date, in your favor for $399, on the Bank of the State of New York, which, deducting one-quarter per cent. paid for check, is the amount of your demand for the use of your patent. We are finding it very useful for efficiency and economy, therefore willingly pay your charge.

"Very respectfully,
Joshua Lazarus, Prest.

"Office of the Gas Co.,
Reading, June 20, 1850.

"Mr. Joseph A. Sabbaton, Albany:

"Dear Sir:—In reply to your inquiry as to the results experienced at these works, in the use of your 'patent mixture' for purifying gas, I have to state that for the last six months, we have used lime alone and your mixture alternately, for months at a time, keeping a strict account of the gas purified by each method in a given time. The books of the company will show that in every instance when the mixture was used more than double the quantity of gas was purified than with lime alone; showing a saving of one-half, at the same time reducing the pressure in the retorts and considerably improving the quality of the gas.

"The company have therefore authorized the payment of your demand for a right to use it in their works.

"Paul A. Sabbaton, Supt."

"Hartford City Gas Works,
August 4, 1851.

"Messrs. Sabbaton & Merrifield:

"Gentlemen:—After a thorough trial of your patent for the purification of coal gas, by the use of a mixture of coke dust and lime, I can recommend it as highly useful and economical, both in purifiying the gas and diminishing the pressure upon the retorts. During the past month we have purified from 13,380 to 16,073 feet of gas with each bushel of lime which has been used; this gas was manufactured entirely from Newcastle coal. I am satisfied that the gas is of a higher illuminating power than when purified with lime alone. The diminution of the carbonaceous deposit upon the interior of

the retorts is an important advantage gained by the use of the breeze; I think the accumulation is not more than one-half as great as by the usual method. We are now entirely free from the inconveniences which often arise from the excess of pressure between the retorts and purifiers where lime alone is used.

"So highly do I esteem your improvement, that I should be most unwilling to dispense with it, and I can cheerfully recommend it to all manufacturers of coal gas. "Yours respectfully.

"THOMAS R. DUTTON,
"Supt. Hartford City Gas Works."

"OFFICE ALBANY GAS LIGHT CO.,
ALBANY, December 1, 1851.

"Messrs. SABBATON & MERRIFIELD:

"Gents:—In reply to your enquiries in relation to your patent method for purifying coal gas, I would state that it has been used in the works of this company for about two years, with the most satisfactory results. I am well satisfied that it possesses all the advantages claimed for it, for efficiency and economy; and that the amount invested by this company in its purchase has been amply repaid by its usefulness.

"Yours respectfully,
"JOEL RATHBONE, Prest."

American versus German Petroleum.

In circles well posted on the subject it is asserted that the petroleum wells discovered in Germany give but little promise of permanency. The *Iron Age*, in speaking of this matter, says:

Consul Canisius has repeatedly taken occasion to refer to the vast importation of petroleum from the United States to the ports of Geestemunde and Bremerhaven, Germany, and also communicated to the State Department the successes of the recently discovered petroleum in the Lüneburger Heath, which created such an excitement throughout Germany. It was believed at the time, and stated in the newspapers, that Germany would henceforth free herself of her dependence upon the United States for this article, for which millions of marks have to be remitted to our country every year. According to Consul Canisius, however, the wells in that part of the country have almost ceased to produce petroleum. The chief reason for this, he thinks, is probably that the oil produced there is much inferior to the excellent article imported, this opinion being supported by the fact that the refined petroleum of Oelheim, which was put in our market and tried, met with an unfavorable reception on account of its low grade. Similar results were attained wherever it was sold, and the reaction in the Lüneburger Heath petroleum industry was consequently so great that many of the companies have ceased operations.

Perusing Consul Canisius's report, we find that the enthusiasm of last summer disappeared, and the stocks of the companies could not be sold even at a heavy decline. The creditors of these concerns finally concluded to demand a liquidation, and this seemed the final closing up of the great petroleum companies in that region. The company with which a certain Mr. Mohr was connected, and which it is said a Berlin bank bought up, decided to call a meeting of the stockholders to determine the dividends for the first half year. The majority concluded to pay 6 per cent. This decision is, however, considered as a mere speculation on the part of those most interested to bull the stocks of the company, and then immediately to dispose of them. Nineteen of the stockholders impeached the legality of the meeting. The Oelheim Petroleum Industry Company, in order to show that the production was not as bad as it was represented in the papers, published the following interesting statement:

"The society worked three pits, with an average daily yield of 10 to 12 barrels; six pits with an average daily yield of 15 to 18 barrels; eight pits with an average daily yield of 15 to 18 barrels; one pit with an average daily yield of 5 to 6 barrels; two pits with an average daily yield of 5 to 6 barrels; five pits with an average daily yield of 5 to 8 barrels; nine pits with an average daily yield of 15 to 20 barrels; eleven pits with an average daily yield of 15 to 20 barrels."

According to this statement the total production during the three weeks of observation was from 85 to 98 barrels per day. The price per barrel of the raw material was between 18.05 marks and 21 marks. The expenses, the report says, cannot be given accurately, but can only refer to the amortization of the boring towers. The Berlin *Gazette* declares. however, that this statement must be taken with reserve. Although the oil fever rose to an unprecedented height last summer, it was easily foreseen that it would, in a short time, subside to its present dead level. The fervent hopes of German patriots of driving the "blue-barreled Yankees" from the vast petroleum stores at Geestemunde, Bremerhaven, and other places have not been realized, and probably will not be for a very long time. The losses which the investors suffered through Oelheim companies have warned the people in this country that it is just as unsafe to invest in petroleum industries in Germany as in Galicia or in Russian Poland.

The decline of the Oelheim petroleum industry is, moreover, shown by the fact that the large number of empty petroleum barrels, bought up for future use at Oelheim, were recently sold to Bremerhaven firms that ship such barrels to New York, Philadelphia, and Baltimore. There was a decrease in the importation of refined petroleum into Germany during the year 1881 to the amount of 48,957,654 kg. (107,706,838.8 pounds). This may have been caused by a higher import duty, by the excitement over the newly discovered oil wells in Hanover, or by speculation.

Consul Canisius gives the subjoined statement of the total number of barrels of petroleum on hand at the different places at the end of the last quarter:

Bremen	481,296	barrels.
Hamburg	74,399	"
Antwerp	284,189	"
Rotterdam	42,825	"
Amsterdam	75,466	"
Stettin	48,090	"
Dantzic	31,765	"

Barrels containing petroleum which at 21° Reamur develops inflammable gases, are marked "inflammable" in white on a red ground. In quantities of less than 110 pounds, they must be marked "To be used for lighting only, with particular care." This law, to which several objections have been raised, will go into effect on June 1, 1883.

The Coal Fields of Nagasaki.

The *Journal of the Society of Arts* publishes the following relating to the coal fields of Nagasaki:

The field from which the main supply of coal for the Nagasaki market is obtained is situated under the sea and islands, and along all the coast line, extending northward from Cape Nomo, in the south, up to the entrance of Nagasaki Harbor, and thence in a westerly direction almost to Hirado-shima, the most northerly of the Goto Islands. This field has an area of 900 square miles, but it is impossible accurately to define the limits either on the west or southern sides, owing to the fact that the strata here are totally submerged by the sea. Consul Jones states that the coal-bearing stratum of the Nagasaki district seems to be referred to the Tertiary period, though it is the opinion of Professor Nordenskiodd, who devoted some time to the study of the rocks, that they might more justly be classed as Permian.

The coal is described as being highly bituminous, of irregular appearance, inclining toward cubical, having, when freshly broken, a lustrous black appearance, which changes by protracted exposure to atmospheric influence, to a dull rusty black. The known seams of workable coal vary considerbly in thickness, the thinnest seam wrought being one barely 3 feet in thickness, which is worked at Hira-shima; and the thickest being an 18 feet seam, worked at Taka-shima. Consul Jones states that it is almost impossible, with any degree of accuracy, to state what the total thickness of workable coal may be, but the "Goto Tankosha," a mining company in whose hands the greater portion of the coal field is placed, have already proved and worked, at their Taka-shima mines, coal seams of an aggregate thickness of 50 feet The existence has also been proved, near Matsu-shima, of two seams of coal, each measuring 7 feet in thickness, and there are several seams of from 4 to 5 feet at present being worked on other islands, notably Koyaki, Iwo-shima, and Okishima, but in a primitive manner, by native miners.

At present the supply of coal is almost entirely derived from the workings of the "Goto Tankosha," at their mines, which are situated at Taka-shima, a small Island of from 300 to 400 acres in extent, lying abont 8 miles southwest from Nagasaki. As far back as history can be traced, a few fishermen were the only inhabitants of this island, and in making fires to light their fishing operations, and in certain seasons to attract the fish by lights suspended from their boats, they found and used for this purpose the first outcroppings of the coal, which circumstance originally attracted attention to, and was the cause subsequently of discovering the existence of the coalfields. Coal was known to exist in, and has been obtained from, the island by the Japanese for the last two centuries, but the quantity extracted has been small, and the mining operations as carried on by them simple and rude, consisting principally in following down the coal seams from their outcrop at the surface, until the quantity of water draining in from above became too great for their rude pumping appliances to deal with. This latter event generally occurred at a point varying from 100 to 150 yards from daylight, and when it took place the working was abandoned and fresh outcrops prospected for. The system of working which was in use in these old native operations was of a very rude description, bearing a strong resemblance to the old method for extracting the vein in metalliferous mining. Most of the mining operations were carried on by native miners without the assistance of

foreigners, still partake very much of this character, though they have been greatly modified by the example offered by the works which are being prosecuted under foreign supervision.

At the present time the works are in the hands of a Japanese company, called the "Goto Tankosha," the miners being chiefly Japanese acting under the authority of a foreign manager and engineer. The average daily output of coal from this company's mines is as at present about 1,000 tons, with the capacity for supply double that quantity when required. The coal is obtained from three separate seams, measuring respectively eight, ten and eighteen feet. As most of the workings extend from the island out beneath the sea, considerable difficulties have to be encountered in contending with water, engines with a total of 200-horse power being used in pumping. The dip and rise of the stratum at Taka-shima being very steep, the haulage is carried on by engine power—the power being transmitted through steel-wire ropes of two inches in circumference. The aggregate length of engine rods below ground is over three miles.

As the workings have been extended, large quantities of fire-damp have been encountered, and this has necessitated a very elaborate system of ventilation. Fans are in use for this purpose, which pass a quarter of a million cubic feet of air through the mine per minute. All the mines are illuminated by means of locked safety lamps, the "Clanny" being the form more generally in use. Several severe explosions have occurred in the mines, the last taking place in April, 1880, when several miners were killed. There are about 4,000 workmen in and about the Taka-shima mines; these include a very competent staff of mechanics.

The coal is conveyed in native junks from Taka-shima to Nagasaki, about 100 of these being kept in constant employment. The laborers and miners of the Taka-shima Coal Company live on the island, in houses built by the company in Japanese style, and these form a considerable village. They are supplied with provisions by the company at cost price. The wages for ordinary labor are from fourteen to forty-five sens per day; skilled labor and the foremen of gangs receive higher wages, about seventy-five sens per day. The miners are divided into parties or squads of five persons, two to dig or cut the coal, and three to carry it to the tramways. These are paid in proportion to the quantity of coal they handle—that is to say, by the cattie. Women and children are employed in the mines, and receive the lowest wages, viz., fourteen sens per day. A day's labor consists of eight hours, either by day or night. A miner is at no expense for clothing, a straw sandal being usually his only garment. Consul Jones mentions a curious circumstance in connection with the subject of coal mining, which is, that notwithstanding the abundant supply of coal, its proximity, convenience, etc., it is not used by the Japanese for heating or cooking purposes in the city of Nagasaki. The houses are constructed for a summer climate, without fireplaces or chimneys, and are heated, when the weather is cold, by charcoal burned in small portable vessels, made either of porcelain, or wood called "hi-bachies." The cooking is also done over the "hi-bachi."

The Japanese Government have also lately opened out a new field of coal in the Higo district of the province of Nagasaki, at Müke. This new colliery is supplied with all the latest foreign mining machinery, and is carried out under the superintendence of a foreign mining engineer. It has an output capacity of from 300 to 400 tons per day, and the coal is shipped from the port of Kuchinostu, which has been opened to foreign ships for that purpose.

The yield of coal from the Müke mine, for the year 1880, amounted to 142,235 tons, of which 17,904 were sold in Japan, and 124,331 destined for consumption in China.

Some Practical Notes on the Seasoning of Building Woods.

There have, perhaps, been as many papers written relative to the seasoning of wood as have been contributed to the discussion of any other purely technical question.

The subject is one to which theorists in particular have devoted a large share of their attention. The matter, indeed, has, for the greater part been theoretically rather than practically discussed, and whilst an extreme degree of attention has been directed to issues of comparative unimportance, others of material importance have been overlooked. It is hoped by this paper to supply some of the deficiencies which exist.

Commencing upon our inquiries, it is perhaps as well, in the first instance, to inquire what the seasoning of wood really amounts to. It appears to be a prevalent notion that some extraordinary chemical effect upon the juices and saps of wood is brought about by the process of seasoning. Such theories as are, however, held by some scientists possess very little interest to those who make use of wood only as a constructive material.

For practical purposes a given effect is required. Wood is required to be seasoned, and what is mainly wanted to be known upon the subject is, what is the best and most economical method of obtaining the desired result? By what is commonly known as seasoning wood is meant nothing more than drying wood.

Wood is to be dried only by the moisture being evaporated from it. It is an elastic material, and in degree as the moisture exudes so it will shrink. It is also by nature somewhat absorbent, and it will therefore, under certain conditions, attract and retain moisture. For instance, if highly dried woodwork be fixed in a thoroughly damp house, the wood will absorb some moisture, and being of an elastic nature, it will re-expand just in proportion to the amount of moisture it has absorbed. When the house has become dry, the wood also will have dried, and the result of the expansion and afterwards of the contraction will be a number of open joints. For these open joints the joiner may receive much censure, although it is highly possible that he may not have been at all in fault. Indeed, if the wood he has used has been highly dried it will, in all probability, have absorbed more moisture than would have been the case if it had only been partially dried, and so when it shrinks again the openings left will in such a case be wider.

Woodwork to be fixed in a newly-erected and, consequently, damp building should have received a coating of paint before being fixed, as, in such a case, it will not absorb moisture.

These remarks may suggest the inquiry why unpainted woodwork does not continually undergo a process of expansion and contraction. The question is not a difficult one to reply to, although it has not usually been answered in our way.

It is well enough known that wood, in a living state, forms a skin over any exposed portion. Thus, if a branch be lopped off a tree the injured limb for a time will bleed its sap. Nature, however, supplies its own protection against injury, and a thin skin is soon formed over the injured part, which stays the bleeding. It is the same, to some extent, with dead as with living wood. Flooring-boards, for example, which have been laid down for ten or almost any other number of years, will, if planed over, enter upon a second process of shrinking or expansion, according as they are situated in a dry or humid atmosphere. To season wood, then, is simply to dry it, and that means nothing more than evaporating the moisture from it. For all practical purposes, therefore, we have only to inquire—

First. What amount of seasoning is required?

Second. What is the best way to accomplish the seasoning process?

The issues are, consequently, narrowed very considerably.

When we ask ourselves what amount of seasoning is necessary, we must hold steadily in view the requirements of the different purposes for which wood is employed.

And, first of all, it should be clearly explained that foreign-sawn woods undergo a limited amount of seasoning before they leave the other side of the water. It would not at all do to store green wood into the unventilated holds of ships, for if such a thing were done the wood would at once commence to "sweat." In a short time it would become covered with a mildew and the sap-wood would become permanently discolored; it would then have depreciated very much in commercial value. To avoid such an occurrence the wood is for a time seasoned abroad under large wooden sheds before being shipped. It is in consequence of being seasoned under sheds that it usually reaches us of such an excellent color and clean appearance.

The bulk of the foreign building wood imported is used for bearing or joisting purposes. For such purposes it is not necessary that it should be at all seasoned beyond the preliminary seasoning it undergoes previously to shipment. It is a common error to suppose that old wood is in any way better for bearing purposes. A kind of vague idea has generally existed that old wood is necessarily better seasoned, and that it is better that it should be seasoned.

In a vague way this view is held to, and yet no one can say in what way bearing wood is benefited by being seasoned. As a matter of fact, it is usually more or less injured by being old.

At the timber-yards deals are, as a rule, most indifferently piled. They are not generally in any way protected from the weather, nor are they stored in such a manner as will insure any water which falls upon them running off quickly again. If not piled so that air can circulate through them, and if moisture be present, decay will rapidly supervene.

If the sun's rays be allowed to approach the ends and sides of deals, a splitting process occurs. Should wet weather then follow, these cracks will become filled with moisture. When frost follows upon wet the splitting process continues, and the deals often become in consequence much shaken. Old deals will have endured these contingencies, and it may be taken for granted that they will not have escaped scatheless. Consequently, it is better on the whole to employ perfectly new wood for all kinds of bearing work.

Wood, however, that is intended to be made up into joinery work must be seasoned; and it is left to us to inquire as to the best way of accomplishing the seasoning process.

There are two matters to be considered in relation thereto. First, the wood has to be dried. Secondly, it is not to be injured in the process of drying. The injuries that can be done to the material are those caused by the

sun, rain, and frost, and by the dirt if it be stored in the immediate neighborhood of a large town. The only sufficient protection against these influences is a suitable shed for the wood to be placed under. The sides and ends of the shed must, of course, be open to admit of the air circulating freely through the deals or boards required to be dried. Thus all that is required is a suitable roof. Such a roof should be exceedingly flat, so as to admit of the convenient piling away of the deals or boards under it. It should be made to well overhang so as to serve in the double capacity of a sunshade and an umbrella to keep off the sun and the rain. It should also be made capable of being raised or lowered at will, so that it can be placed over any pile. It should be built in the most exposed part of the builder's premises, for no other factor is so important in relation to the seasoning of wood as is the wind. If it blows a gale, so long as it does not upset the piles, it is all the better for the purpose of seasoning.

Deals and boards, when placed for seasoning, should alike be separated at regular intervals by evenly sawn strips of wood. It is better that boards should be seasoned when lying in a horizontal position, because they are then less likely to twist or warp whilst being dried. The long and the short pieces should be piled separately, and in no case should a long board be allowed to overhang without any support, or it will be certain to twist. It is worth while taking care in this respect—as it is only the more valuable qualities, those intended to be used for joinery purposes, that are required to be seasoned at all.

Flooring-boards will probably have to be seasoned in the open, because room will not, probably, be found for them under the drying-sheds. If such a thing is possible, then it is all the better, but it is a matter of less importance that flooring-boards should be protected from the weather than any other kind of wood that is required to be dried. When flooring-boards are to be dried in the open, it is better that they should be "perched" on their ends, rather than laid out in a horizontal or triangular form. When piled in a triangular form the boards are exceedingly liable to sway at their centers, and thus they will be likely to dry in a twisted form. They also hold at times a considerable amount of water in such a case. It is a good plan, when stacking flooring-boards on a perch, to pile the boards in pairs with their face sides together, as in such case the faces of the boards are kept clean, and thus the necessity of replaning the faces of the boards when laid is rendered unnecessary. As we pointed out in the commencement of this article, seasoned boards will enter upon a second shrinking or expansion process if their newly-formed skins be removed with a planing-iron. There are those persons who are in the habit of drying their flooring-boards before passing them through the planing machines. This is done so as to have a perfectly clean board when laid, but, for the reasons given, the result is not satisfactory, and further than this, clean faces can be preserved by adopting the practice of stacking the boards in pairs to dry.

For certain processes, such as mould-making, for instance, wood must be highly dried, and in such cases "stoving" may be resorted to with advantage. The main reform, however, required to be effected in respect to the seasoning of building wood appears to be the more general erection of suitable and sufficient drying-sheds, having open sides and flat movable roofs. Doubtless the erection of such sheds necessitates the expenditure of a considerable amount of money, but it is as well to bear in mind the admitted adage that what is worth doing at all is worthy of being done well. There can be no doubt but that most consumers of wood suffer heavily through losses incurred in consequence of the depreciation of stock which has not been sufficiently well cared for. A well designed and suitably situated drying-shed will permit of the wood which is stored under it being perfectly seasoned, and yet kept free from dust and grit, whilst the havoc which the sun, the rain, and the frost usually commit upon wood that is undergoing the process of being dried will be altogether avoided.

It should be well borne in mind that wood often suffers very much in consequence of its having been stored away in the sale timber-yards without any sort of protection, and it is to be hoped that ere long some protective provisions, in the shape of sheds, will be brought into general requisition by the timber merchants. Until such protective provisions do become generally established we would strenuously advise builders to buy, when possible, newly-arrived stock, and to take care themselves of that portion which they intend to devote to joinery or other similar purposes.—London *Builder*.

The Painting of Iron Surfaces.

A very interesting paper was read some time ago by Mr. William Meeking, before the Civil and Mechanical Engineers' Society of London. It contains many valuable hints and suggestions as to the proper covering of iron surfaces with paint. We make the following extracts:

Of the varieties of lacquers and paints used it is needless to speak at length as the all important point is the actual state of the iron surface when the first coat is laid on. If that is not in proper condition no subsequent application, however good in itself, has any chance of being permanently preservative, and I think that that proper state is found when there has been formed upon the whole surface of the work a thin layer of the first or black oxide, which has been, while hot, thoroughly permeated by and incorporated with a resinous and tarry covering.

Once formed, everything goes well. Additional coats of paint may be applied from time to time to renew the thickness of the original covering, but the iron underneath remains unattacked. If, on the contrary, a film of hydrate oxide (ordinary rust from exposure) be once allowed to form, the successive coats of paint are thrown off sooner or later, and, in the meantime, the rust has spread under the paint. A striking instance of this may be generally seen after outdoor riveted work has been in place for some time. As a rule all the riveting is done before the final painting is commenced, and each rivet head has in the meantime been exposed to the damp atmosphere; the paint invariably commences to peel off the rivet heads long before it leaves the adjacent plates, and when this has once taken place nothing but a thorough scraping off of the surface will give the paint any chance of adhering. So slight are the differences of manipulation which determine whether a given piece of work shall or shall not rust away, that I think they may all be found in the different methods of manufacture pursued now and formerly. Taking the case of a piece of ornamental iron work, which in so many instances has come down to us in unimpaired beauty and condition, it would be now probably forged in detail in one part of a factory, drilled, filed and fitted in another, and when completely finished be painted "in three coats of best oil paint."

Formerly the smith who forged the work punched the necessary holes at the same time, fitted the various pieces together as he went on, completing each piece as he proceeded, doing all the work with his hammer, and, to quote an old book of directions to good smiths, "brushing his work over with linseed oil, and suspending it for some time over a strongly smoking wood fire." This will give at once a sort of elastic enamel coat, perfectly adherent, calculated to preserve the iron to the utmost.

To come to practical uses, it appears to me—

First—That in all cases where iron is used externally there should be the most careful provision made for draining off water, and preventing any lodgment in inaccessible places.

Second—That the iron used should be in the largest and most compact masses possible, with a due regard to the necessities of construction, avoiding, by all means, such designs as are calculated to provide the largest possible surface for a given weight of metal.

Third—To take care that, before the metal leaves the iron works, and while heated, it receives a coat of some protective substance, such as tar or linseed oil, which shall be allowed to incorporate itself with its external surface and form a durable substratum for future coverings.

Compressed Fuel versus Coal.

The London *Mining Journal* indulges in the following speculations concerning this subject—

When the coal trade is said to be unprofitable, as we hear on all sides at the present time, and when the small material known as slack or smudge only realizes from one to two shillings per ton, it is somewhat surprising to find that our mineowners have made no attempts to get out of the old ruts in which they and their predecessors have moved. Coal is sent to market just as it is found, whilst a good deal of fine slack made in cutting and bringing down is left in the pits.

Now, there does not appear to be any necessity for using coal in its ordinary form, or why it should occupy the space that it does, seeing that it has been proved that compressed fuel can be made to yield all the advantages we derive from coal without the many disadvantages. On the Continent, and along the shores of the Mediterranean fuel bricks are most extensively used, and are found easy of transport inland. In France there are several large works in connection with mines where the slack is converted into bricks, and these are now entirely used in the French navy, being preferred for several reasons to the coal in its lumpy state. If compressed fuel, therefore, is found advantageous for steam purposes there is certainly no reason why it would not be found suitable for ordinary household burning as well. Were it so adopted less room would be required for storing a given quantity, whilst there would not be the dirt and dust that are inseparable from coal as it is now delivered in our cellars. There would also be a great difference in the price of it and coal, with very little as regards the heating power for all ordinary purposes.

In France the fine coal is well washed, so that all impurities are removed from it, which is more than can be said with respect to our ordinary fuel, in which we have clinkers and pyrites, by no means pleasant, as they shoot out their mineral particles from the fire, besides which there is a greater amount of ash than there ought to be, showing the earthy mixture sent out with the coal.

During the last two or three years large quantities of compressed fuel have

been shipped at Marseilles for Egypt and the Mediterranean, and last year about twenty of these vessels unloaded at Alexandria, and several at Port Said and Suez. The fuel has been found much better adapted to the Egyptian market than ordinary coal, especially for the purpose of being transported into the interior, and the buyers, in consequence of the small *pratique* and waste given by the compressed fuel, prefer it to ordinary coal, whilst it also is found to be most suitable for long transport either by railway or by water.

But the exportation of the brick fuel, as it has been termed, from Marseilles is not exclusively directed to Egypt, for it is sent to the Turkish ports and the Danube, a good deal going direct to Constantinople. In the shipment of compressed fuel, too, we believe there is no extra insurance premium to be paid, seeing that from the report of our own Royal Commission with respect to the spontaneous combustion and explosion of coal cargoes there has been no case recorded of such combustion having taken place in cargoes of compressed fuel. This no doubt is due to the mode of manipulation and the art of compressing.

The bricks are prepared from disintegrated or crushed coal, agglomerated by either pitch or farinaceous matter, and when compressed in the moulds are dried in ovens. Being then subjected to considerable heat, so that not only is the moisture or the volatile portion of the pitch or tar expelled, but carbonaceous oxidation also takes place, and whatever fire-damp existed in the cells of the coal is expelled.

The necessary machinery for producing bricks is by no means costly, and at coal mines there is always sufficient power for carrying on the work, whilst the ordinary brick-making machines, some of which are capable of producing from twelve to fifteen thousand blocks a day, could be made available. There are also mixing machines at present in use that are by no means expensive. The small coal could be purchased from 1s. 6d. to 2s. per ton at least, and if 2s. 6d. per ton is allowed for the cohesive material and the working into bricks, it is evident that the latter could be sold at such a price as would ensure an extensive demand.

If produced as it could be the probability is that it would supersede coal, especially in large towns at a distance from any coal mining district. In London, in particular, it would soon make its way, being so easy of carriage, whilst the bricks might be made of a certain weight—so many going to make up a hundredweight. Compressed fuel, containing other material besides coal, might also be considered outside the city dues.

However that might be, we think that those colliery owners who turn their attention to the utilizing of the small and waste coal by converting it into compressed fuel will find it greatly to their advantage to do so.

Gas Lighted Harbor Buoys.

Engineering states that the third large gas lighted harbor buoy has just been completed and turned over to the Trinity House authorities. These buoys are made spherical, 9 feet in diameter, containing inside a cylindrical vessel about 5 feet in diameter, the two being riveted together and gas tight joints made. The shell consists of eight sections and a top and bottom plate made of three-eighth inch steel plates and double-riveted in the seams, steel of about 26 tons tensile strain being employed. On the top of the spherical buoy is a low square frame, constructed of angle irons and bars, which carries the gas lantern. Both the internal cylinder and the space between cylinder and sphere contains gas at high pressure, and these buoys are constructed to burn for 100 days without requiring to be refilled. The object of having a double casing is that in the event of an accident to the outer shell, the inner cylinder shall still contain sufficient gas to keep the lamp alight until the buoy can be removed; the two chambers communicate by a valve opening inwards to the cylinder, and in case of damage to this sphere this valve is forced to its seat by the pressure inside. The buoys are tested with an air pressure up to 100 pounds per square inch, all joints being painted over with soap and water. They are an excellent job in both design and workmanship.

Mixing Concrete.

Mr. John Jackson, of Kensington, England, has devised an apparatus for mixing the materials used in the making of concrete more cheaply and without engine power. The apparatus consists of a main trunk or shoot supported in a vertical or approximately vertical position open at its top, where it is provided with a hopper, and also open at its bottom, the bottom preferably tapering or inclining inwards towards the opening.

The main trunk has in its interior shelves which incline downwards, and project alternately from opposite sides of the interior of the trunk, and are so situated relatively one with the other, that when the materials to be mixed are thrown into the hopper they fall down the first inclined shelf and therefrom on to the next inclined shelf and so on from shelf to shelf until they pass from the open bottom of the said main trunk or shoot into a truck or receptacle placed to receive them, the materials being thoroughly mixed together in their passage from shelf to shelf as explained. Where the materials are to be mixed with water as they pass down through the apparatus this may be effected by water pipes so led into the interior of the main trunk or shoot and so perforated that on water being forced into the said pipes it issues from the perforations thereof, meeting the materials preferably in their descent from one shelf to another.

Street Lighting in Fond du Lac, Wisconsin.

A number of the residents of Fond du Lac, Wis., have concluded that the electric light is neither what has been claimed nor expected of it, and consequently are much displeased with its workings and effect. The disappointment is the more severe considering many of these were advocates of the tower system of lighting. On Division, Harney, Linden, Second and other thoroughfares residents are now negotiating for a continuance of gas lamps at or near their residences so that the pedestrian may have light. Division street, east of Portland, will soon be lighted by gas, paid for by private individuals, while on the corner of Second and Harney streets the light of a particular gas lamp has never been extinguished. In addition to these precautions it is averred that a number of influential and wealthy citizens, and all heavy taxpayers, will petition the council to repudiate the electric light as per contract, after the expiration of 60 days, as not satisfactory, nor up to the standard promised.

Enameling Cast Iron Pipes and other Castings.

In an article which recently appeared in our columns, we gave an account of a Bohemian invention for the annealing of cast iron pipes, etc., during the casting operation in the foundry, and in the course of which it was stated that the process, as yet, was secret. It appears, however, that this is not the case, and in one of our English exchanges a correspondent submits a number of receipts for the enamel, depending on the purpose for which it is applied. One, for water pipes, is as follows: 28 parts by weight of silica, 11 of calcined carbonate of soda, and 6 of carbonate of lime. Another is 34 parts of silica, 11 parts of carbonate of soda, 12 of chalk and 11 of dried pipe clay, to which boracic acid or oxide of lead can be added when a more vitreous enamel is required.

The core forming the inner surface of the pipe, and, if desirable, the mold also, is coated with black lead, and the enamel as a powder or paste is applied to the thickness required. The molten iron, as already stated, causes the enamel to soften and firmly adhere to the iron. If it is not necessary that the enamel should be smooth, the black lead may be omitted.

It appears that the enameled pipes are very much appreciated in Bohemia. This is evidenced by the fact that the Municipal Council of Egar have passed a resolution to use no other kind. The pipes are now being manufactured in several works in Germany and Austria, and it is said that arrangements will shortly be completed for licensing one or more firms in Great Britain.—*Iron Age*.

Darkness in Wabash, Ind.—On September 21st, at eight o'clock, P.M., the works of the Wabash Gas Light Company were levied upon by the county treasurer, and the supply of gas shut off. The result was that the city was left in darkness. It was thought that arrangements would be made for resuming operations on the following day, but we have not been informed as to whether the negotiations were successful.

Correspondence

[The Journal is not responsible for the opinions expressed by correspondents.]

The Edison System.

Washington, D. C., September 27, 1882.

To the Editor American Gas Light Journal:

Thinking the old adage may be true, that "you have to go from home to learn the news," I beg to acquaint you with the substance of a conversation I have just had, with an electrical inventor of no mean capabilities, concerning Mr. Edison's alleged recent triumph.

His information was derived from an electrician just returned from New York, who, as I understood, was summoned to your city for consultation on the subject. My informant stated that Mr. Edison has just met with the greatest disappointment of his life—the complete failure of his attempt to light 2,500 houses with his incandescent lamps by his underground system of wires; but 50 houses could be lighted, the electricity being conveyed away owing to imperfect insulation. As the insulation was supposed to be perfect the conclusion is that underground conductors cannot be made to work.

Very respectfully,

X.

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MONDAY, OCTOBER 2, 1882.

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OCTOBER 2, 1882.

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	Capital.	Par.	Bid.	Asked
Gas Co.'s of N. Y. City.				
Central	$466,000	50	75	85
Harlem	1,800,000	50	97	100
" Bonds	170,000			103
Manhattan	4,000,000	50	220	223
Metropolitan	2,500,000	100	175	178
" Bonds	658,000	..	105	108
Mutual	5,000,000	100	103	106
" Bonds				
Municipal	1,500,000	100	180	187
" Bonds	750,000		106	110
New York	4,000,000	100	117	120
Northern	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	102	105
Citizens	1,200,000	20	68	70
" S. F. Bonds.	320,000	1000	105	107
Fulton Municipal	3,000,000	100	75	80
Peoples	1,000,000	10	40	45
" Bonds	290,000	.	104	107
" "	250,000	...	78	90
Metropolitan	1,000,000	100	70	—
Nassau	1,000,000	25	55	60
" Ctfs.	700,000	1000	93	96
Williamsburgh	1,000,000	50	57	60
" Bonds	1,000,000	...	100	101
Richmond Co., S. I.	300,000	50	70	75
" Bonds	40,000	—	—	—
Out of Town Gas Companies.				
Buffalo Mutual, N.Y	750,000	100	—	75
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	—	—
" " Bds.	124,000	—	10	10
Chicago Gas Co., Ills			125	—
Cincinnati G. & C. Co.			178	180
Consolidated, Balt.			42	43
Bonds			107	—
East Boston, Mass	220,000	25	122	128
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	140	144
Halifax N. S.	400,000	40	148	150
Hamilton, Ontario	350,000	40	117½	
Jersey City	750,000	20	155	160
Jacksonville, Ill	120,000	50	100	...
Lewistown Maine	400,000	100	—	100
Laclede St Louis Mo	1,200,000	100	117	—
Montreal, Canada	2,000,000	100	168	170
New Haven, Conn		25	132	—
Oakland, Cal			32	33
Peoples, Jersey City		...	75	80
" " Bds.			...	...
Pittsfield, Mass			120	130
Rochester, N. Y		50	70	80
Wilmington, Del		50	174	...
Yonkers		50	30	32
St. Louis Missouri	600,000	50	250	254
San Francisco Gas-Co., S. Fr'isco Cal.			68	69
Toledo, Ohio			95	97
Troy, Citizens	600,000	100	—	—
Washington, D. C	1,500,000	20	215	220
" Scrip	375,000	15	245	250

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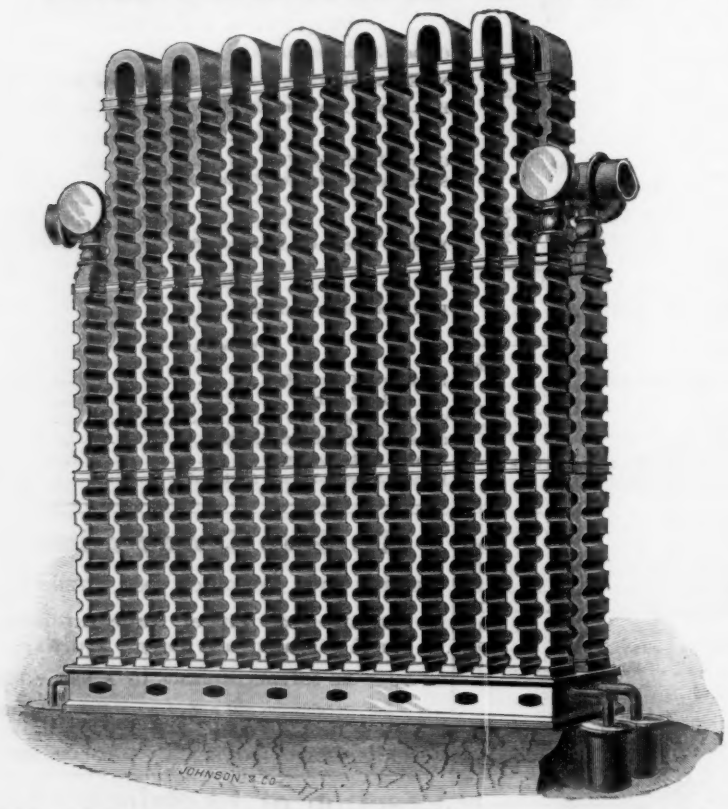

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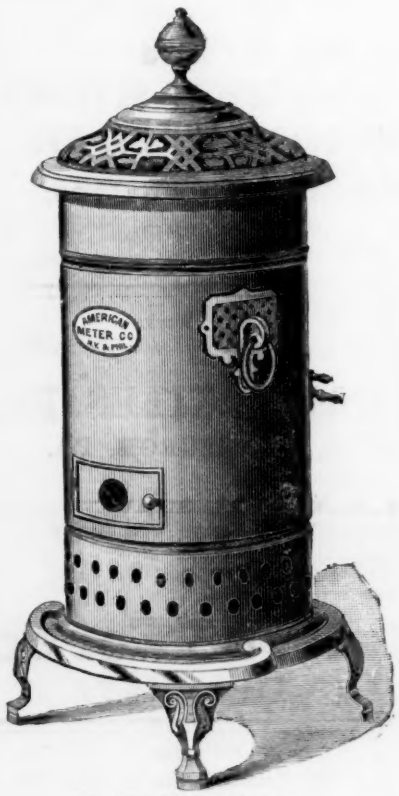

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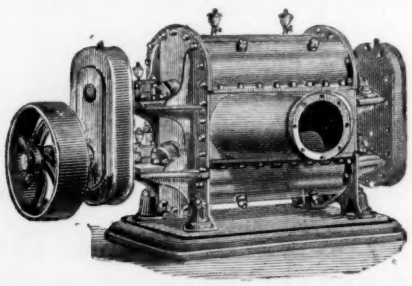

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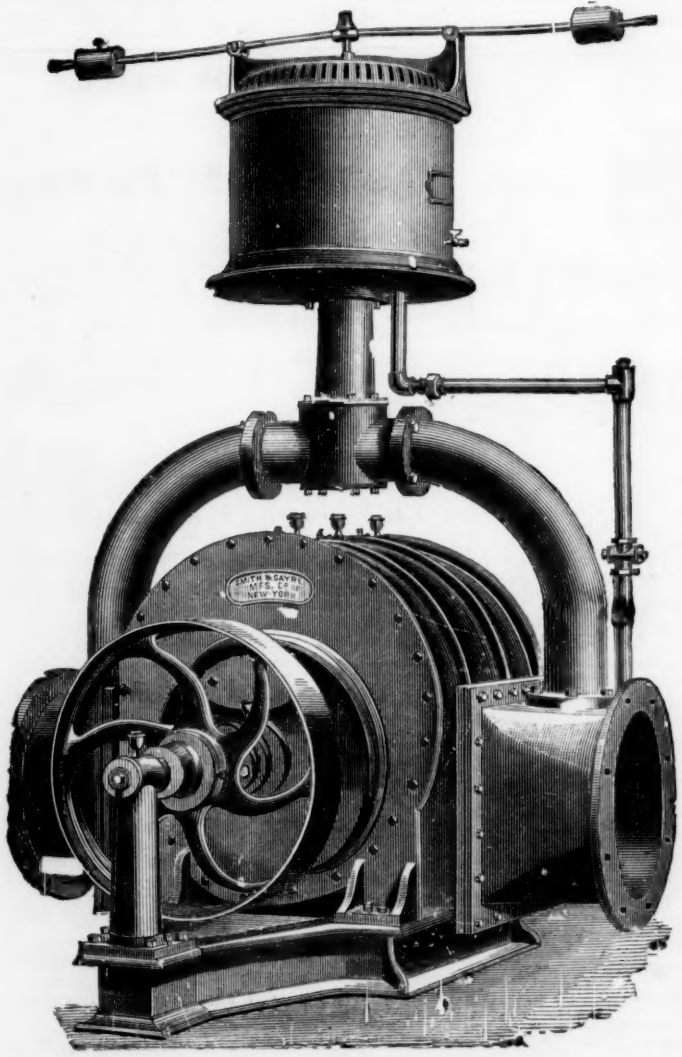

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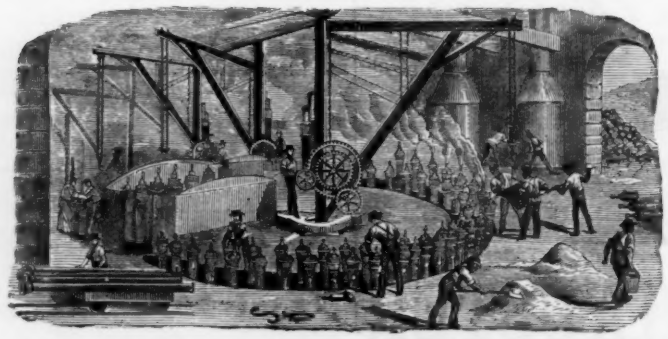

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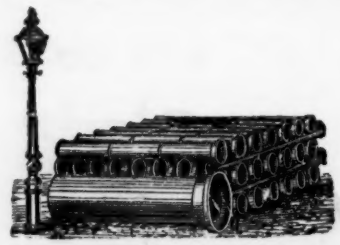

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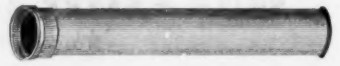

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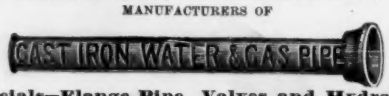

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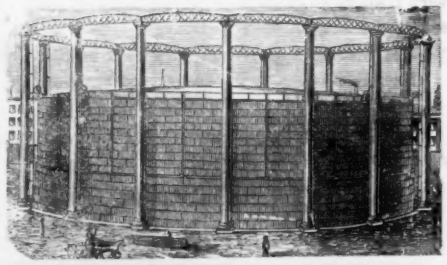

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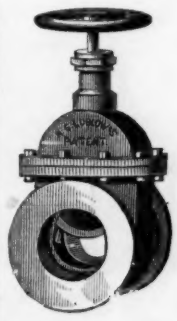

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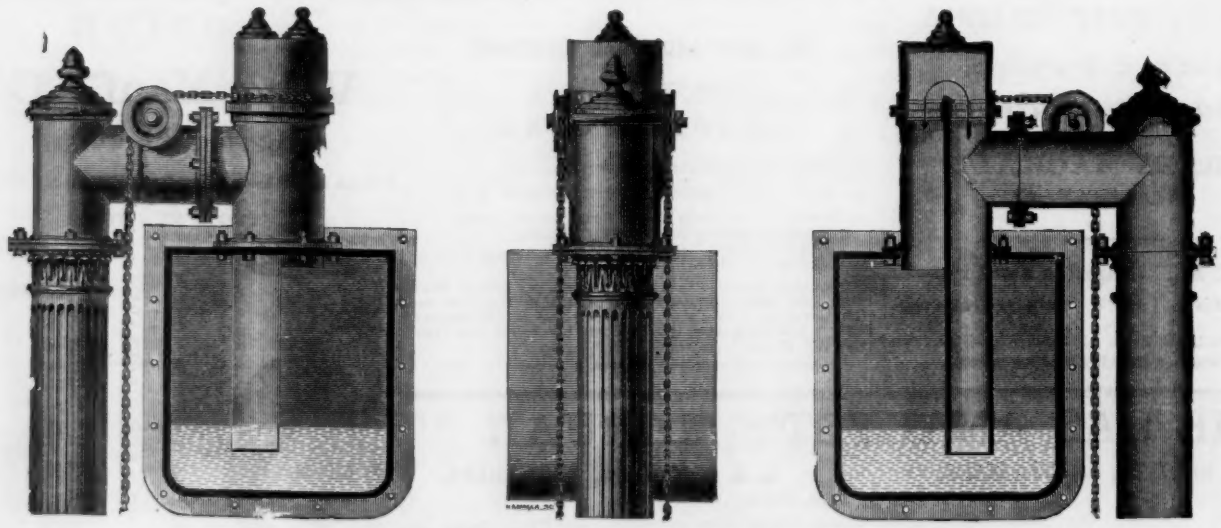

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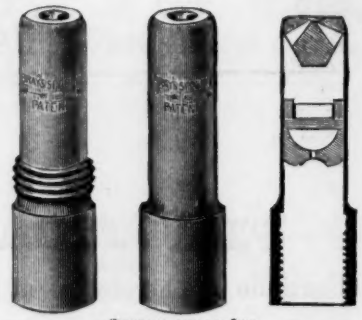

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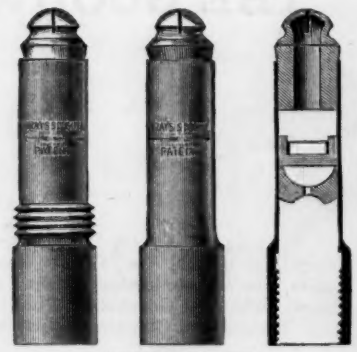

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The following table and sentences in quotation marks are taken from the report of S. C. Ford, the United States Inspector of Gas and Meters at Washington, D. C., for the year 1881:

Description of Burner.	Pressure at points of ignition.	Actual consumption of gas per hour.	Illuminating power in candles at rate of actual consumption.	Illuminating power in candles, at rate of 5 cu. ft. per hour.	Value of one foot of gas in terms of standard candles.
	Inches.	Cubic Feet.	Candles.	Candles.	Candles.
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" Special Slit-Union No. 7.....	.50	4.74	19.20	20.25	4.05
" " " No. 6.....	.50	4.10	16.61	20.25	4.05
" " " No. 5.....	.50	4.24	16.97	20.01	4.00
" " " No. 4.....	.60	3.49	12.58	18.02	3.60
" " Union Jet No. 7.....	.50	4.84	19.13	19.76	3.95
" " " No. 6.....	.55	4.32	17.10	19.79	3.95
" " " No. 5.....	.60	4.14	15.65	18.90	3.78
" " " No. 4.....	.55	3.38	12.04	17.81	3.56
" Regulator Union Jet No. 7.....	.50	4.99	17.69	17.72	3.54
" " " No. 6.....	.50	5.18	17.68	17.01	3.40
" " " No. 5.....	.60	4.37	13.71	15.68	3.13
" " " No. 4.....	.60	3.97	11.46	14.43	2.88

"On examination of the above table of tests, made with various burners, it will be observed that the illuminating power obtained with Bray's special burners Nos. 5, 6, and 7, both slit-union and jet form, was high; but with Bray's regulator burners only moderately good."

"The result of test with Bray's standard slit-union burner was highly satisfactory. This burner is best suited for street illumination, and will yield the maximum power obtainable from a cubic foot of gas."

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